Aalto University
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WHERE DO INTERNATIONAL FIRMS LOCATE THEIR HEADQUARTERS?

An empirical study of headquarters' cross-border relocations in Europe

Master's Thesis
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Abstract

The last decades have seen an increasing trend of high-growth firms and established multinationals looking across country borders to find the optimal location for their headquarters. This thesis investigates where international firms locate their headquarters using a unique dataset of 168 headquarters' cross-border relocations to urban areas in Europe from anywhere in the world between 2009 and 2019. The theoretical background builds from not only economic geography but also international business literature to take advantage of the multi-disciplinary perspectives on the research topic. More specifically, this study enriches the understanding of which locational characteristics of agglomerations, urban environment, and country environment are central when international firms choose a location for their headquarters. Owing to these three geographical levels, this study offers an extensive and unique view of these location choices.

Headquarters of international firms are prone to locate in urban areas that are close to other units of the same firm and have low taxes on especially corporate income but also on labor income, high-quality institutions and stable political environment, large airports, small population, many headquarters or other activities in the same industry sector and good availability of support services. Airports are particularly important for intermediary headquarters whose operations between the corporate center and subunits of their firm are crucially dependent on good airline connections. The importance of locational characteristics at all three geographical levels shows that a broader view across these levels contributes to a more comprehensive understanding of headquarters' location choices.

The results exhibit insightful differences to previous studies in terms of country conditions, wages, airports, and distance to other units of the same firm. While few other studies focus on country conditions embodying institutions and political stability, the increasing prevalence of technology-intensive operations is likely to make them more and more important for headquarters. Measuring headquarters-specific wages instead of the general wage level suggests that, contrary to what many previous studies conclude, wages are not a central consideration in headquarters' location choices and their influence is positive when it exists. Wages thus manifest the high skills required from employees working in headquarters. Lastly, the focus on cross-border relocations of international firms' headquarters in Europe highlights the importance of airports and minimized distance between the headquarters and other units of the same firm.

Keywords international firms, headquarters, location choice, nested logit model

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Viime vuosikymmeninä yhä useammat kasvavat ja vakiintuneet monikansalliset yritykset ovat tähystäneet maiden rajojen yli löytääkseen parhaan sijainnin pääkonttorilleen. Tämä tutkielma tarkastelee, minne kansainväliset yritykset sijoittavat pääkonttorinsa käyttämällä ainutlaatuista tietoaineistoa, joka sisältää 168 pääkonttorin rajat ylittävää muuttoa Euroopan kaupunkialueille mistä päin maailmaa tahansa vuosina 2009-2019. Tutkielman teoreettinen tausta perustuu paitsi talousmaantieteeseen, myös kansainvälisen liiketoiminnan kirjallisuuteen ja hyödyntää täten tutkimuksen aiheeseen löytyviä monitieteisiä näkökulmia. Tarkemmin sanottuna tämä tutkimus rikastuttaa ymmärrystä siitä, mitkä taajama-alueiden, kaupunkiympäristön ja maaympäristön ominaispiirteet ovat keskeisiä kansainvälisten yritysten valitessa pääkonttoriensa sijainnin. Näiden kolmen maantieteellisen tason ansiosta tämä tutkimus tarjoaa laajan ja ainutlaatuisen kuvan pääkonttorien sijaintivalinnoista.

Kansainvälisten yritysten pääkonttorit ovat taipuvaisia sijoittumaan kaupunkialueille, jotka ovat lähellä saman yrityksen muita yksiköitä ja joilla on alhaiset verot etenkin yritystuloille, mutta myös työntekijöiden tuloille, korkealaatuiset instituutiot ja vakaa poliittinen ympäristö, suuret lentokentät, pieni väestö, monia pääkonttoreita tai muuta toimintaa samalla teollisuudenalalla ja tukipalvelujen hyvä saatavuus. Lentokentät ovat erityisen tärkeitä välitason pääkonttoreille, joiden toiminta yrityskeskuksen ja alayksiköiden välillä on ratkaisevasti riippuvainen hyvistä lentoyhteyksistä. Sijaintien ominaisuuksien merkitys kaikilla kolmella maantieteellisellä tasolla osoittaa nämä tasot kattavan näkemyksen auttavan ymmärtämään pääkonttorin sijaintivalintoja entistä paremmin.

Tulokset osoittavat oivaltavia eroja aikaisempiin tutkimuksiin maaolosuhteiden, palkkojen, lentokenttien ja muihin yrityksen yksiköihin vallitsevien etäisyyksien suhteen. Vaikka harvat muut tutkimukset keskittyvät instituutioita ja poliittista vakautta ilmentäviin maaolosuhteisiin, teknologiaintensiivisten toimintojen yleistyminen luultavasti tekee niistä yhä tärkeämpiä pääkonttoreille. Pääkonttorikohtaisten palkkojen mittaaminen yleisen palkkatason sijasta osoittaa, että toisin kuin monet aiemmat tutkimukset ehdottavat, palkat eivät ole keskeinen tekijä pääkonttorien sijaintivalinnoissa ja vaikutuksen ilmentyessä se on positiivinen. Palkat ovat siten verrattavissa pääkonttoreissa työskentelevien työntekijöiden korkeisiin taitoihin. Viimeiseksi, tutkimuksen fokus kansainvälisiin yrityksiin ja niiden pääkonttorien siirtymiseen rajojen yli Euroopassa korostaa lentokenttien sekä pääkonttorien ja muiden yrityksen yksiköiden välisen etäisyyden minimoimisen merkitystä.

Avainsanat kansainväliset yritykset, pääkonttorit, sijaintivalinta, nested logit -malli

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1. Introduction

Firms face multiple new questions as they grow, internationalize, and reach for new opportunities abroad. The location of their headquarters is one of the key issues. The pursuit of better efficiency and profitability pushes established multinationals to reconsider their headquarters locations as well. For example, the quest for a more conductive operational environment motivated the North American tech giant Netflix to relocate its European headquarters from Luxembourg to Amsterdam in 2015. The headquarters now operates centralized functions in, for example, marketing, business development, and finance for European, Middle Eastern, and African regions (Netflix, 2017).

The phenomenon of relocating headquarters gives rise to another one, where local officials race for attracting headquarters to their urban areas. Local officials in the Netherlands praised Netflix's arrival in Amsterdam due to the new jobs it created and the positive signal it sent for other leading firms wanting to invest in their future (Invest in Holland, 2019). In addition to creating jobs for highly qualified labor and contributing positively to the image of the location, headquarters attract support services and other headquarters. Similarly, losing headquarters induces employment losses and decreases the quality of labor markets. (Strauss-Kahn and Vives, 2009). Based on these apparent benefits and looming losses, local officials seek ways to retain headquarters and attract more of them in their urban areas.

A specific stream of economic geography literature studies different locational characteristics in play in the location choices of headquarters (e.g. Davis and Henderson, 2008; Bel and Fageda, 2008; Strauss-Kahn and Vives, 2009). In other words, it provides local officials with insights into what makes urban areas attractive in the eyes of headquarters. While economic geography field examines headquarters' locations mostly at a local level, international business literature traditionally studies this topic from a country perspective. A comprehensive understanding of the location choices of headquarters thus benefits from these

interdisciplinary insights that fulfill each other. Attention to this topic has been on an increasing trend during the last two decades in both economic geography and international business literatures, following the increasing occurrence of headquarters relocations. This study covers an extensive sample of studies in both literature streams and analyzes their overlaps and differences. Although the literature successfully studies the importance of specific characteristics (such as services and airports at a local level or taxes and institutions at the country level) in headquarters' location choices, it lacks a broad enough view of different characteristics in play simultaneously at different geographical levels. After all, headquarters are likely to assess the operational prerequisites that agglomerations (referring to the immediate surroundings) around them, the overall urban area, and the respective country offer. These three geographical levels thus provide a useful way to categorize the important locational characteristics.

This study aims to fill in this research gap in the economic geography and international business literatures by identifying the key locational characteristics at the three geographical levels that influence location choices of headquarters in international firms and testing their importance empirically. The focus is on understanding where the headquarters relocate rather than why they relocate. More specifically, this study aims to understand the extent to which characteristics of

- agglomerations (presence of other headquarters, availability of support services and availability of high-skilled labor)
- urban environment (airport facilities, distance to other units of the same firm, wages and population size), and
- country environment (corporate and labor income taxes, as well as country conditions in terms of institutional quality and political stability)

are associated with where international firms locate their headquarters. To my knowledge, this overview is the broadest presented so far in the literature, thus offering unique insights into the relative importance of different locational characteristics.

To empirically measure the importance of each locational characteristic in headquarters' location choices, this study uses a unique dataset covering 168 cross-border relocations of corporate and intermediary headquarters to European urban areas from anywhere in the world between 2009 and 2019. Regardless of the age or size of a firm, relocating headquarters abroad demonstrates its international ambitions. The dataset covers physical relocations meaning that more than just the legal domicile moved. Such a specification is important, especially because pure legal domicile relocations would excessively emphasize the importance of taxes. The rareness of this specification makes this study unique and increases its potential of offering a more detailed understanding of headquarters' location choices. This study estimates the importance of different locational characteristics in headquarters' location choices with a two-level nested logit model. The model measures how locational characteristics influence the probability that a firm chooses a certain urban area for its headquarters. In the nested structure, a firm first narrows down its choices to a smaller group of urban areas based on their region or language before making its final choice within this group.

The main results show that urban areas located closer to other units of the same firm and with lower taxes (especially on corporate but also on labor income), better institutions and political stability, larger airports (especially when considering intermediary headquarters), smaller population, more headquarters or other activities in the same industry as well as better availability of support services are likely to attract headquarters of international firms. The importance of characteristics at all three geographical levels shows that a broader view across these levels offers a more comprehensive understanding of headquarters' location choices. The results are largely in line with previous studies, although emphasizing the importance of especially airports and minimized distance to other units more. The focus on cross-border relocations of international firms in Europe is likely to provoke the greater importance. Furthermore, few previous studies examine the importance of country conditions for headquarters. This study observes that the role of these

conditions becomes increasingly central in location choices when technology-intensive operations that require good institutions, increase in prevalence. Lastly, the estimations with headquarters-specific wages, instead of the general wage level as in many previous studies, suggest that wages are not as central a consideration in headquarters' location choices as previously thought. Their small but positive influence stems from them reflecting the high skills of employees.

The case of Netflix largely confirms the empirical findings. When motivating its choice of Amsterdam, Netflix emphasized particularly attractive labor pools (high skills corresponding to higher wages), location in the European continent (minimized distance) and business-friendly regulations (good country conditions) but also cosmopolitan lifestyle without overcrowding (large airport with international connections and small population) (Invest in Holland, 2019). Compared to London and Dublin (the article refers to Ireland that the capital Dublin represents in the dataset), the other two urban areas that Netflix considered, the data of this study shows that Amsterdam fares better in terms of wages reflecting a high-skilled labor pool, distance, country conditions and population size. Furthermore, the three urban areas offer equally good airline connections. The attractiveness of Amsterdam for Netflix is thus reasonable.

This study is organized in the following way. The next section explains how changes in firms' spatial organization initiate the research topic of headquarters' location choices. It also presents key locational characteristics that firms consider in their headquarters' location choices based on previous studies. Section 3 introduces the rich data used in this study and conducts preliminary analyses of the expected relations between different locational characteristics and location choices. Section 4 justifies the choice of nested logit as the empirical model before introducing the nested logit model in the context of this study and specifying the empirical strategy. Finally, Section 5 goes through the results of the empirical analysis, while their implications for economic geography literature are discussed in Section 6.

2. Modern firms and their headquarters

The majority of economic geography literature on headquarters' location patterns has emerged during the last two decades. Understanding the lack of attention before this requires a look into the evolution of firms' spatial organization alongside the emergence of communication technologies. After explaining how modern firms organize themselves spatially and what is the role of headquarters in their organizations, this section goes deeper into exploring which kinds of characteristics describe the locations of headquarters.

2.1. Spatial organization of firms

The organizational form of firms lays the preconditions for studying their spatial organization. Ota and Fujita (1993) are among the first ones to explain that the way of treating firms as single-unit entities in the traditional location theory has become old-dated. Their study of the firms' spatial organization introduces a multi-unit firm that consists of a front-unit (such as a headquarters) and a back-unit (such as a plant or a back office). Economic geography studies on headquarters' location choices typically construct an organizational form of firms that is aligned with this idea. The organizational form in these studies typically consists of two types of clearly separable units: 1) headquarters units that coordinate the rest of the firm and runs centralized activities and 2) units that focus on production activities (e.g. Davis and Henderson, 2008; Bel and Fageda, 2008; Strauss-Kahn and Vives, 2009).

The interpretation of the headquarters unit in this organizational form varies between studies. Economic geography studies simply acknowledge that firms may have multiple headquarters units (e.g. Strauss-Kahn and Vives, 2009) or label any management, administrative, or supporting units as headquarters (e.g. David and Henderson, 2008). Studies on headquarters' location choices in the international business field offer useful ideas for developing these interpretations further. These studies distinguish two types of headquarters: 1) corporate headquarters that are the highest management unit in the company

structure 2) intermediary headquarters that operate under the corporate headquarters in the company structure and are typically responsible for either a certain geographical region (e.g. European market) or a certain functional activity (e.g. public finance division of a bank) within the company (Valentino, et al., 2019). The literature generally calls these regional and divisional headquarters, respectively. This distinction between corporate and intermediary headquarters is useful because different types of headquarters appear to have different preferences over their locations (Belderbos, et al., 2017; Valentino, et al., 2019).

While the simple multi-unit definition makes modeling easier, it also limits the applicability of results in sectors where a clear distinction between headquarters and production activities is harder to find. Aarland et al. (2007) describe U.S.-based location data of headquarters and production activities and notice that firms in manufacturing, retail, and wholesale typically have distinguishable headquarters and production units. This may explain the heavy focus on manufacturing firms in the literature.

How to spatially organize both types of units then becomes a relevant consideration for multi-unit firms. Duranton and Puga (2005) build on the multi-unit idea of Ota and Fujita (1993) and explain that the spatial organization choices of firms focus on one central trade-off: the multi-unit firms face the choice between 1) integrating the headquarters and other activities in a single location and saving in management costs that arise when the headquarters interacts with other units and 2) separating the headquarters from other activities and saving in operational costs of all units when each can find their optimal environment.

The development of communication technologies triggers an evolution in the spatial organization of firms because it alters this trade-off between integration and separation. More advanced technologies reduce the management costs that drive integration, thus facilitating spatial separation. Communication

technologies thus represent an exogenous force giving rise to multi-location firms (Duranton and Puga, 2005). Aligned with this idea, the model of firms' spatial organization developed by Fujita and Thisse (2006) shows that when communication costs start to decrease as a result of better communication technologies, more or more firms spatially separate their headquarters from their production plants. Eventually, all plants are spatially separated from the headquarters of the firm.

Choosing the optimal location for each unit becomes increasingly important as the organizational form of firms transforms towards multiple units in different locations. An abundance of the crucial inputs a unit needs defines its optimal location (Duranton and Puga, 2005). Aarland et al. (2007) explain that the different inputs used by headquarters and production as well as the concentration of these inputs in different geographical areas justify their spatial separation. While production units benefit from co-locating with other production units to share common intermediate suppliers, headquarters can focus on finding locations where the inputs needed to complete their tasks are available.

The tasks of headquarters evolve around supporting activities within their firm and interacting with other firms. Henderson and Ono (2008), who study where manufacturing firms locate their headquarters, explain that a headquarters 1) coordinates plant activities, 2) provides other units with various support services, and 3) processes information from interactions within the firm and with other firms. In their study of headquarters' spatial concentration in multiple sectors, Davis and Henderson (2008) complete this description by adding that headquarters collect crucial information 1) on input, production, and technology choices for the production plants and 2) on the market conditions that benefits all units of the firm. They also specify that support services usually include strategic, financial, and resource planning as well as centralized administration like legal and accounting services. Lovely et al. (2005) discover that up-to-date information on fast-changing foreign market conditions is

crucial for exporting firms and their headquarters have a central responsibility for acquiring it.

Advanced communication technologies make coordinating activities from a distance significantly less costly and enable headquarters to focus on their other tasks evolving around support service provision and information processing. In other words, they can start seeking better access to support services and information, the two crucial inputs in their operations. Because consuming services and exchanging information requires face-to-face interactions (Davis and Henderson, 2008), headquarters move towards locations where they are close to support services providers and information sources.

2.2. Location of headquarters

The question of headquarters' location is central for multi-unit firms aiming to optimize their operations. While access to services and information proves important based on the headquarters' tasks, firms also consider a multitude of other factors when deciding where to locate their headquarters. Indeed, they are likely to assess potential locations based on the agglomerations (referring to the immediate surroundings) around them, the overall urban area, and the respective country. Using these three geographical levels, this section examines previous theories on how agglomeration economies, characteristics of urban areas, and country-level factors relate to the locations of headquarters. The summary in the end gives a brief overview of important locational characteristics, that forms the basis for the empirical estimations of this study.

2.2.1. Agglomeration economies

The tasks of headquarters indicate that possibilities for efficient information acquisition and support service provision are likely to guide where they choose to locate. When many headquarters follow a similar logic, certain spatial patterns start to emerge. Already Marshall (1920) identifies knowledge and service inputs, alongside labor pools, as central factors explaining why

establishments like headquarters concentrate spatially. These three factors motivate concentration because of the locally increasing returns that arise when nearby establishments exchange knowledge spillovers, share intermediate inputs, and employ from the same labor market (Marshall, 1920). The economic geography literature knows these increasing returns from concentration more commonly as agglomeration economies. Since headquarters depend on knowledge exchanges between each other as well as on similar support service and labor inputs, these agglomeration economies apply to them too. More and more headquarters thus choose to locate in places where service and labor inputs as well as other headquarters are present.

Economic geography studies acknowledge that the presence of other headquarters in the same industry and the diversity of available support services are the core sources of agglomeration economies influencing headquarters' location choices. Aiming to quantify the forces defining agglomeration of headquarters in the U.S., Davis and Henderson (2008) find out that agglomeration economies from the knowledge exchanges between headquarters in the same industry are initially large but decline rapidly as distance increases. The observed decline indicates that the own industry agglomeration economies are not strong enough alone to explain the spatial patterns of headquarters. Rather, they need the support of agglomeration economies from sharing diverse support services. Strauss-Kahn and Vives (2009) measure how support services and headquarters both overall and in the same sector influence the location choices of headquarters among large firms in the U.S. Their findings follow those of Davis and Henderson (2008), indicating significant positive results for all three agglomeration economies. The availability of support services proves particularly important also in their study.

Henderson and Ono (2008) find less consistent evidence regarding how the presence of own industry headquarters influences the first-ever location choices of stand-alone manufacturing headquarters in the U.S. Since their sample of headquarters differs from that of Davis and Henderson (2008) and Strauss-

Kahn and Vives (2009) who study relocating headquarters, Henderson and Ono (2008) suspect that headquarters benefit less from knowledge spillovers at their first establishment. At that moment, they are more influenced by the competitive threats that other headquarters and companies in their industry induce.

The economic geography literature offers less convincing evidence regarding the third agglomeration economy that relates to labor pools. Marshall (1920) explains that establishments choose to locate in places where a good selection of labor with the needed skills is available. However intuitive this idea seems, economic geography studies of headquarters' locations and agglomeration economies do not estimate or find consistent evidence for the importance of high-skilled labor pools. Davis and Henderson (2008) and Henderson and Ono (2008) only consider the other two agglomeration economies from other headquarters and support service offering. Strauss-Kahn and Vives (2009) find that the influence of labor pools is consistently positive but insignificant.

Studies that do find significant positive results arguing for the importance of these labor pools ignore the other two agglomeration economies. Klier (2006) estimates a positive relation between educated labor pools and location patterns of headquarters in a simple analysis of large public companies' location choices in the 1990s. Belderbos et al. (2017) find a significant positive estimate for the availability of human capital in their simplest specification for studying how regional headquarters choose their locations among global cities around the world. Neither of them includes variables for the presence of other headquarters and the availability of support services in their analyses.

These results support the idea that while the availability of highly skilled labor is important for headquarters, the presence of labor pools overlaps with the other two agglomeration economies. Firstly, headquarters benefit from knowledge exchanges that happen in interactions between the employees of different headquarters (Fujita and Thisse, 2006). In this sense, the pools of high-

skilled labor are an implication of the presence of headquarters using this kind of labor. Secondly, support services also employ high-skilled labor, which is why their presence implies that high-skilled labor pools are available as well.[1] Both explanations suggest that the availability of appropriate labor is not important for headquarters' location choices on its own. Rather the agglomeration patterns prompted by other headquarters and support services are enforced by the labor patterns that follow them (Duranton and Puga, 2005).

2.2.2. Characteristics of urban areas

Many economic geography studies compare the attractiveness of urban and metropolitan areas instead of countries for a relevant reason: they are embodiments of the core agglomeration economies. Urban areas attract headquarters by offering chances to interact with other headquarters and access diversified support services. The density of urban areas benefits headquarters because it enables closer interactions and facilitates personal information exchanges between their skilled workers. Thus, the density supports the delivery of headquarters' tasks. (Ota and Fujita, 1993; Duranton and Puga, 2005; Fujita and Thisse, 2006).

In addition to helping external information acquisition, urban areas facilitate dissemination of knowledge within organizations, further improving the overall efficiency of delivering headquarters' tasks. Many studies measure the capacity of delivering headquarters' tasks in an urban area by the availability of airport facilities, the number of foreign destinations served, and the frequency of flights (Klier, 2006; Bel and Fageda, 2008; Strauss-Kahn and Vives, 2009). They find proof for the importance of these connectivity factors in both location choices of headquarters and local efforts for retaining headquarters. In their study on the

[1] Strauss-Kahn and Vives (2009) find that the availability of educated labor and support services both have an insignificant influence on headquarters' location choices when they are measured together but a significant positive influence when the other one is omitted. They explain this through the high correlation between educated labor and support services stemming from the fact that these services employ educated labor.

role of high-quality transportation facilities in headquarters' location choices in Europe, Bel and Fadega (2008) explain that the delivery of support services and the exchange of especially tacit and complex information requires face-to-face interactions. The consequent need for employees in headquarters and other units to travel and meet each other explains why headquarters want to locate in urban areas with good airline connections.

Connectivity considerations offer perhaps the most promising area for comparing corporate and intermediary headquarters in terms of their location choices. Such comparison is scarce in economic geography literature up to today, but especially international business studies highlight the differences in the roles of different headquarters. In addition to the corporate center, international firms have regional and divisional headquarters in charge of certain geographical areas, divisions, or even combinations of them (Laamanen, et al., 2012). Belderbos et al. (2017) argue that international connectivity needs are more apparent among regional headquarters than among corporate ones. The same applies to divisional headquarters since they operate similar activities as regional headquarters do. These intermediary headquarters play the role of mediators between the corporate center and subunits in different locations, transmitting information and support services between them. Since such activities require face-to-face interactions (Davis and Henderson, 2008), having good connections to all corners of the world is a central concern when firms choose locations for their intermediary headquarters.

Distance to the units the headquarters serves also affects the efficiency and costs of delivering headquarters' tasks (Strauss-Kahn and Vives, 2009). Both Strauss-Kahn and Vives (2009) and Henderson and Ono (2008) find significant negative coefficients for their distance variables, which suggests that locating headquarters further from other units decreases the profitability of a firm. In other words, headquarters would benefit from being located in urban areas with central locations relative to other units of the same firm.

There exists, however, industry-specific operational requirements that affect firms' preferences over distance. Previous studies running specific analyses with manufacturing headquarters suggest that minimizing the distance to production units is important for them. Henderson and Ono (2008) run their analysis only with manufacturing headquarters, whereas Strauss-Kahn and Vives (2009) offer a comparison of headquarters in general and in manufacturing. While minimizing the distance to other units proves more important for manufacturing headquarters, they turn out almost indifferent to the availability of airports. The specific features in manufacturing activity thus seem to require closer interaction with the headquarters and production units, increasing the benefits from operating in physical proximity.

Urban areas also entail a negative trade-off for improving the delivery of headquarters' tasks since the concentration of economic activity and population increases the congestion levels compared to the surrounding areas. Congestion is costly and unattractive for headquarters who need to compensate their employees for the higher living costs. All the while, congestion costs drive away other units, such as manufacturing plants, who do not benefit as strongly from agglomeration and thus cannot afford to pay higher wages. (Duranton and Puga, 2005). In their study of manufacturing firms' location choices, Henderson and Ono (2008) indeed find that manufacturing units concentrate in rural or smaller urban areas.

Previous studies theorize that congestion costs, proxied by average wages and population size, decrease the attractiveness of urban areas in the eyes of headquarters and similarly increase the likelihood that headquarters move away from urban areas (Klier, 2006; Bel and Fageda, 2008). However, the empirical results of the studies are not at all or only weakly significant. Strauss-Kahn and Vives (2009) emphasize that studies must estimate the importance of wages and population together and simultaneously with variables capturing agglomeration economies. Estimating the influence of wages and population together is important since they are likely to correlate (congestion from larger

population drives wages up) and excluding one would exaggerate the other's influence. When estimated alone, wages can capture the availability of high-skilled labor, and population size the availability of both high-skilled labor and support services. However, the agglomeration economy variables should normally capture these availabilities.[2] Strauss-Kahn and Vives (2009) conclude that although the influence of population size proves insignificant, lower wages consistently and significantly increase the attractiveness of an urban area for headquarters. Their results thus indicate that firms try to minimize congestion costs.

It is, however, central for headquarters to consider the relationship between the wages and skills of their employees. Egger et al. (2013), who analyze different labor-related factors influencing the locations of headquarters around the world, are the first ones to consider how the emphasis put on wages changes when highly skilled labor is available. Their results show consistently that the availability of highly skilled labor decreases the importance of wages in headquarters' location choices. Thus, there seems to exist an important trade-off between wages and the skills of employees that firms consider when choosing a location for their headquarters.

2.2.3. Country-level factors

Alongside agglomeration economies and characteristics of urban areas, headquarters are likely to consider the country-level context of their prospective locations. First of all, taxes centrally influence headquarters' location choices (Strauss-Kahn and Vives, 2009; Voget, 2011; Laamanen, et al., 2012). Since they influence operational costs and net income directly, higher taxes reduce the attractiveness of a location for the headquarters of a profit-maximizing firm. Strauss-Kahn and Vives (2009) and Laamanen et al. (2012) measure the

[2] Strauss-Kahn and Vives (2009) find that wages and population size positively and mostly significantly attract headquarters when they exclude variables for agglomeration economies from the analysis. However, these relations turn negative as soon as they include agglomeration economy variables.

importance of taxes among other locational characteristics attracting headquarters and find that corporate income taxation is a particularly important characteristic in this regard. Voget (2011) focuses on studying the influence of international tax policies on headquarters relocation choices worldwide and concludes that headquarters perceive taxes for repatriated foreign profits as unattractive.

While most studies focus on corporate taxation, Egger et al. (2013) point out that also labor taxation is a central consideration regarding international locations of headquarters that use high-skilled labor intensively. They motivate the focus on labor taxation through the fact that it is harder to avoid than corporate taxation. While employer-borne income taxes influence firms' profits directly, employee-borne income taxes affect the efforts exerted by employees and thus, their influence on firms' profits is indirect. Egger et al. (2013) argue that high-skilled employees are both more sensitive to these taxes in terms of efforts they are ready to exert and more mobile across borders. Consequently, favorable labor income taxes define where high-skilled labor is available and thus where headquarters are likely to move. They study the importance of multiple labor taxation elements separately and conclude that especially high labor income tax rates, high progressivity, and employer social security contributions reduce the attractiveness of a location in the eyes of headquarters.

In addition to the general level of taxes, tax incentives serve as a separate tool to attract headquarters. The increased welfare in the surrounding areas can justify tax incentives since headquarters generate information spillovers and might be home-biased in investment and production decisions (Voget, 2011). In their study of tax incentives in cities, McGuire and Garcia-Milà (2002) explain that any agglomeration economies generated by headquarters suffice to justify tax incentives. The positive externalities from headquarters must, however, be quantitatively measured to define the sum of incentives. Since quantifying incentives merits a research topic on its own, this study ignores it completely.

Headquarters require stable and conductive country conditions to operate the most efficiently. A study of European multinationals' location strategies by Ascani et al. (2016) concludes that the quality of surrounding institutions is the more relevant the more sophisticated the industry sector or company function in question is. Sophistication among industry sectors means a higher prevalence of advanced technologies while sophisticated functions refer to headquarters and research and development units. Among institutions, Ascani et al. (2016) highlight the importance of favorable business regulation, high-level contract enforcement, and lack of government involvement in the business sector.

Country conditions such as institutional quality and political stability have, however, received little attention so far in the economic geography literature studying headquarters' location choices. The U.S. context of many economic geography studies possibly explains the lack of attention. Measuring the importance of institutional quality or political stability in location choices is not possible in such studies due to the lack of large enough institutional and political variance across the U.S. states. Another explanation is that majority of economic geography studies focus on locational characteristics at a more local level (typically metropolitan areas) rather than analyzing locations more broadly in multiple geographical levels.

Studies on headquarters' location choices in international business literature can offer useful insights regarding the country conditions since they focus more on comparing countries instead of smaller local areas. Institutional and political differences between regions and countries emerge more clearly in the multi-country contexts of these studies. It is relevant in such research contexts to measure the influence of institutional quality on location choices since globalization has broadened the geographical scope of and thus institutional variance between locations that firms consider for their headquarters. Also, recent political instability in Europe, such as Brexit in the UK or Catalonian independence campaigns in Spain, has driven many headquarters to relocate. These real-life examples suggest that political stability greatly influences

headquarters operations. Valentino et al. (2019) conduct a forerunner study in this regard by focusing on the importance of institutions in intermediary headquarters' relocations in Europe. They use a dataset collected with the same method as in this study and observe that a decrease in institutional quality in the host country, measured by indices on law and order, bureaucracy quality, and corruption, increases the probability of headquarters' relocation away from there. These results need more evidence in their support.

2.2.4. Summary of locational characteristics that attract headquarters

After discussing the versatile literature related to the locational characteristics that are attractive in the eyes of headquarters, it is useful to summarize the key points that then form the basis for the empirical estimations. Therefore, this section goes through the most important insights that existing literature offers on the attractive characteristics of agglomerations, urban areas and countries respectively.

The theorization and empirical evidence are strongly consistent about the attractiveness of agglomeration economies stemming from the presence of other headquarters and the availability of support services close by, especially when both appear simultaneously. These factors also largely explain why urban agglomerations form and sustain themselves. While theories argue for the role of labor pools as one of the three core agglomeration economies, empirical estimations largely ignore them. The evidence that does support the importance of highly-skilled labor in headquarters' location choices lacks simultaneous measurement with other agglomeration economies. Therefore, labor pools must not be ignored once and for all. Instead, it is appropriate to shift the focus on studying whether labor availability is important on its own or whether it is solely an implication of the other two agglomeration economies being present.

The literature presents strong evidence for the attractiveness of airport facilities for headquarters since good airline connections facilitate face-to-face interactions needed in delivering their tasks. The connectivity aspect is

especially important for intermediary headquarters. Both theories and evidence suggest that their role as mediators between different parts of the firm translates into growing needs for airports with good connections. In addition to airport facilities, distance to other units of the firm affects the cost of delivering headquarters tasks since interactions become more difficult as distance increases. Studies that measure the importance of minimizing the distance from headquarters to other units find significant positive results, especially for manufacturing firms.

In theory, congestion costs, accumulating when population and economic activity concentrate in urban areas, decrease their attractiveness for headquarters. An empirically supported implication of congestion for headquarters is the need to compensate employees' higher living costs with higher wages. On the contrary, the negative influence of a larger population lacks consistent empirical support. Previous studies argue that simultaneous measurement of wages, population size as a congestion measure, and agglomeration economies is crucial, and a coherent overview of these different factors involved in headquarters' location choices requires further evidence. A comprehensive overview also takes into account the interplay between wages and high skills of headquarters' employees since previous evidence supports the lower importance of wages when high-skilled labor is available. The trade-off between skills and wages is central in headquarters' location choices when profit-maximizing firms try to find qualified labor for their headquarters' operations.

It is essential for estimations of headquarters' location choices to consider the attractiveness of not only corporate income but also labor income taxation. The latter is crucial for headquarters whose operations are intensively dependent on high-skilled labor. The country conditions characterized by the quality of institutions and political stability are another locational characteristic highly important for headquarters but lacking systematic empirical evidence in its support. The European context of this study provides an excellent opportunity

to provide further evidence concerning the role of country conditions in headquarters' location choices.

Overall, previous literature offers extensive insights into what kinds of locational characteristics in agglomerations, urban areas, and countries attract headquarters. However, to the best of my knowledge, no previous study in the literature considers characteristics on all these geographical levels simultaneously. This study uses this window of opportunity to broaden the view that the literature offers on headquarters' location choices.

3. Data & analyses

Estimating location choices of headquarters requires data on headquarters and their movements as well as on the characteristics of potential locations. This section first presents and analyzes the data related to headquarters. Then, it introduces the secondary data used to measure the relevant locational characteristics and conducts preliminary analyzes to set out the potential influences of these characteristics on the location choices of headquarters.

3.1. Headquarters in Europe

This study aims to understand where headquarters are located in specific years and where headquarters move in Europe. Therefore, the headquarters data consists of two parts: a population dataset maps out the overall number of headquarters in European urban areas and a relocations dataset covers events of headquarters moving to European urban areas. The next two subsections present and analyze the data regarding the population and relocations of headquarters, respectively.

3.1.1. Overview of headquarters

The literature review proposes that headquarters locate in the proximity of other headquarters. Studying this agglomeration pattern of headquarters in Europe requires a well representative dataset of all headquarters in Europe. I gather a population dataset of all headquarters belonging to both international and purely domestic firms in European urban areas between 2009 and 2019 from the Orbis database. Orbis database is suitable for identifying the population of headquarters since it contains extensive ownership, contact, business, and status information. The ownership information that indicates the organizational structure of each firm allows to identify headquarters units defined as having at least one branch unit of the same firm connected to them. The registered address in Orbis confirms the location of each headquarters at

NUTS 3 level.[3] The business information exhibits the yearly turnover produced by the headquarters unit and the NACE industry sector of the firm where it belongs to.[4] Finally, the status information helps to exclude all inactive headquarters units as well as those whose information has not been updated in Orbis for the last three years. This specification ensures that all headquarters selected to the population dataset are operative.

I aim to construct a panel data indicating the number of headquarters in each European urban area between 2009 and 2019. Due to limited access to historical data in Orbis, the headquarters data covers information from three time points in 2013, 2016, and 2019 while assuming that the locations of headquarters have remained unchanged during the years in between. Thus, the 2013 data defines headquarters' locations from 2009 to 2013, the 2016 data from 2014 to 2016, and the 2019 data from 2017 to 2019. Collecting information on the headquarters of 50,000 largest firms by yearly turnover for each time point aligns the methodology with that of Strauss-Kahn and Vives (2009).

Table 1 below lists the 30 largest urban areas by headquarters' count. In addition to cities, the list includes both several subareas of large cities, such as Westminster in London, and larger areas than just one city, such as Helsinki-Uusimaa. Such differences stem from the use of NUTS 3 regions for identifying urban areas and the variance in the methodology for identifying these regions in different countries. In general, Europe divides to NUTS 3 regions whose population varies between 150,000 and 800,000. However, some countries use administrative regions, such as Helsinki-Uusimaa, to define NUTS 3 regions by combining several NUTS 3 equivalent regions. The methodology allows this as long as the average population size of these regions fits into the defined limits.

[3] NUTS classification is a hierarchical system used by Eurostat to divide the European economic territory. NUTS 3 regions are the smallest regions used for specific diagnoses. (Eurostat, 2019). An interactive map of NUTS regions is available at https://ec.europa.eu/eurostat/statistical-atlas/gis/viewer/themes/.

[4] NACE refers to the economic activity classification used by Eurostat. This study uses the industry main sections of the classification system (e.g. section A refers to agriculture, forestry and fishing).

(Eurostat, 2019). Urban areas are thus somewhat inconsistent, an issue addressed when explaining the measurement of locational characteristics in the next section.

Nevertheless, these statistically consistent regions are purposely built for specific regional diagnoses in Europe which makes their use relevant in this study. Previous studies focusing on the European context also use the NUTS 3 regions to identify urban areas (e.g. Bel and Fadega, 2008). When referring to European urban areas, this study thus refers to these NUTS 3 regions that include cities, their subareas, and larger areas around cities.

Table 1: 30 largest urban areas by number of headquarters

Top 1-15	Number of HQs	Top 16-30	Number of HQs
Madrid, ES	1600	Yvelines, FR[1]	307
Paris, FR[1]	1288	Seine-Saint-Denis, FR[1]	301
Hauts-de-Seine, FR[1]	1195	Halle-Vilvoorde, BE	300
Barcelona, ES	1034	Hamburg, DE	293
Camden & City of London, UK[2]	917	Berkshire, UK	288
Stockholm, SE	818	Skåne, SE	283
Westminster, UK[2]	719	Munich, DE	280
Milan, IT	631	Great Amsterdam, NL	276
Brussels, BE	622	Lisbon Metropolitan Area, PT	272
Helsinki-Uusimaa, FI	587	Valencia, ES	267
Antwerp, BE	521	Berlin, DE	262
Vienna, AT	468	Metropolitan Copenhagen, DK	254
Rhône, FR	452	Bouches-du-Rhône, FR	251
Västra Götaland, SE	362	Hertfordshire, UK	237
Nord, FR	320	City of Copenhagen, DK	233

Note: The number of HQs is the average number across the three time points. [1] indicates that the area belongs to the Île-de-France region. [2] indicates that the area belongs to London. This study uses the commonly used English name of an urban area when available.

An important remark is that the population dataset does not allow tracing the evolution of headquarters' count in different urban areas. The number of headquarters in an urban area can decrease simply because the headquarters it

hosts account for fewer revenues or because the headquarters elsewhere account for relatively more revenues. Regardless of this deficiency, the population dataset allows this study to measure the number of headquarters in each urban area in different years. It is important to acknowledge, however, that a more exact estimate for each year could increase the precision of the estimations.

3.1.2. Relocations of headquarters

This study maps the headquarters relocation events using the same method as Valentino et al. (2019). Together with other researchers, we collected newspaper articles in nine languages (English, German, Italian, French, Spanish, Finnish, Norwegian, Swedish and Danish) from the LexisNexis database and other supporting sources such as Factiva and local business news.[5] To verify that the relocation has taken place, we collected at least one official company source for the majority of cases.[6]

The information about headquarters relocations collected from the news articles includes the initial and destination country and urban area, year of relocation, and headquarters type (corporate or intermediary), as mentioned in the source. The company sources and Orbis database serve to identify the NACE industry sector and to ensure that all relocations concern physical parts of the headquarters, not just its legal domicile. Other important parts concerned in relocations are the management activities that headquarters perform and the top management team leading the headquarters unit. It is crucial to exclude pure legal domicile relocations because they could overestimate the importance of corporate income taxes. Furthermore, only physical presence brings out the importance of for example airport facilities and agglomeration economies.

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[5] Both LexisNexis and Factiva are historical databases that offer functions to search for newspaper articles based on specific keywords and the date of publication.

[6] The company sources include press releases, stock market notifications, annual reports and extracts from the company website. These are sometimes hard to find if the relocation has happened in the early 2000s and the website archive does not reach so far back in time, or if the company has merged into another and the old website is no longer functional.

Given that few sources directly state which parts of the headquarters the relocation concerns, carefully considering each case individually ensures the highest possible quality of data. Any incomplete or inconsistent information in different sources leads to excluding the case. Overall, this methodology enables the collection of a unique and high-quality dataset of headquarters' relocations that no organization providing public statistics services maintains at the European level.

The relocations dataset includes a total of 266 relocations across country borders within and from other continents to Europe between 2009 and 2019. In this case, European countries include EU-28 countries plus Norway and Switzerland. The focus on European locations is meaningful because of not only the availability of consistent secondary data but also the clear lack of studies on headquarters' location choices looking at different geographical levels in Europe. The focus on cross-border relocations in turn offers a unique opportunity to study international firms since no matter how big or old a firm is, locating headquarters abroad manifests international ambitions. This study uses the relocations data to understand why firms choose a certain urban area for their headquarters rather than why they choose to relocate away from their current location. Meanwhile, this study does not aim to understand whether relocation choices are different from other types of location choices, such as those made when setting up a firm and its headquarters for the first time.

A crucial remark is that the relocations dataset covers only headquarters relocations that have been mentioned in newspapers. Therefore, it does not cover all headquarters relocations between 2009 and 2019 and is most likely biased towards larger firms for two reasons: 1) larger firms get more media attention and 2) firms need to be sufficiently large to have previously established a headquarters and have now decided to move it. Since the aim is not to capture the complete picture of where headquarters are moving, these facts do not diminish the relevance of this data for this study. Furthermore, the focus on large firms aligns the relocations data with the population data.

It is important to ensure that all the location choices included in the analysis are based on actual locational characteristics, and not, for example, the firm's or the owner's roots in a specific location. These motivations could lead to firms choosing locations that host only little headquarters and provide a few other resources that headquarters need. Therefore, this study limits the potential European urban areas to those hosting more than 0.2% of all headquarters (50,000) in at least two of the three time periods (2009-2013, 2014-2016, and 2017-2019).[7] Hosting enough headquarters for at least two periods ensures that these urban areas are attractive to headquarters in the long-term and that the selection does not exclude urban areas that happen to drop below the critical line for one period due to for example yearly variation in turnovers.[8] Thus, this selection reduces the noise in the analysis and supports a more truthful picture of the importance of locational characteristics in headquarters' location choices. Table 2 below lists all 83 potential urban areas. Excluding relocations to other urban areas results in a final sample of 168 headquarters' relocations.

Table 2: Potential urban areas in alphabetical order by country

Urban area, country	Urban area, country	Urban area, country
Linz-Wels, AT	Navarra, ES	Great Rijnmond, NL
Vienna, AT	Sevilla, ES	Utrecht, NL
Wiener Umland/	Valencia, ES	Lisbon Metropolitan Area, PT
Südteil, AT	Vizcaya, ES	Porto Metropolitan Area, PT
Antwerp, BE	Zaragoza, ES	Skåne, SE
Brussels, BE	Helsinki-Uusimaa, FI	Stockholm, SE
Ghent, BE	Bas-Rhin, FR	Västra Götaland, SE
Halle-Vilvoorde, BE	Bouches-du-Rhône, FR	Berkshire, UK
Hasselt, BE	Essonne, FR[1]	Birmingham, UK
Kortrijk, BE	Gironde, FR	Cambridgeshire, UK

[7] Strauss-Kahn and Vives (2009) limit the potential metropolitan areas similarly to those hosting more than 0.1% of the total of 50,000 headquarters. I increase the limit to 0.2% (i.e. 100) because including all 184 urban areas with at least 50 headquarters would complicate the empirical analysis. The number of potential urban areas (83) corresponds now better to that of Strauss-Kahn and Vives (2009), which is 106.

[8] Firms' yearly turnovers affect the potential urban areas since the locations of the 50,000 largest firms' headquarters define these areas. If the turnover of some firms located in a specific urban area decreases, they might drop out of the top 50,000 list which results in the urban area "losing" headquarters in the current research setting.

Table 2: Potential urban areas in alphabetical order by country (continued)

Urban area, country	Urban area, country	Urban area, country
Mechelen, BE	Haute-Garonne, FR	Camden & City of
Turnhout, BE	Hauts-de-Seine, FR[1]	London, UK[2]
Berlin, DE	Ille-et-Vilaine, FR	Greater Manchester
Düsseldorf, DE	Isère, FR	South West, UK
Frankfurt am Main, DE	Loire-Atlantique, FR	Haringey & Islington, UK[2]
Hamburg, DE	Maine-et-Loire, FR	Harrow & Hillington, UK[2]
Hannover, DE	Nord, FR	Hertfordshire, UK
Köln, DE	Paris, FR[1]	Hounslow & Richmond
Munich, DE	Pas-de-Calais, FR	upon Thames, UK[2]
Munich District, DE	Rhône, FR	Kensington & Chelsea
East Jutland, DK	Seine-et-Marne, FR[1]	and Hammersmith &
City of Copenhagen, DK	Seine-Maritime, FR	Fulham, UK[2]
Metropolitan	Seine-Saint-Denis, FR[1]	Leeds, UK
Copenhagen, DK	Val-de-Marne, FR[1]	Leicestershire & Rutland, UK
South Jutland, DK	Val-d'Oise, FR[1]	North Hampshire, UK
Athens, ET	Yvelines, FR[1]	Oxfordshire, UK
Barcelona, ES	Dublin, IE	Staffordshire CC, UK
Guipuzcoa, ES	Milan, IT	Tower Hamlets, UK[2]
Madrid, ES	Luxembourg, LU	Westminster, UK[2]
Murcia, ES	Great Amsterdam, NL	West Surrey, UK

Note: This study uses 2-digit ISO codes to identify countries. [1] indicates that the area belongs to the Île-de-France region. [2] indicates that the area belongs to London. This study uses the commonly used English name of an urban area when available.

The most interesting observation at this point is that the list of potential urban areas includes no Swiss urban areas because they host less than 100 headquarters. [9] Consequently, the relocation sample excludes 46 relocation cases to Swiss urban areas. Since Switzerland is often perceived as a tax paradise for multinational firms, the importance of corporate income taxes is probably lower than if potential urban areas also included Swiss ones. Furthermore, the relocations dataset includes no relocation cases to Eastern European urban areas. This observation allows concluding nothing definitive about the attractiveness of these urban areas for headquarters of international firms partly since the methodology used for collecting the dataset does not cover

[9] Zurich, as the largest urban area in Switzerland based on the number of headquarters, hosts between 16 and 20 headquarters during the time period.

news articles in Eastern European languages. Nevertheless, this study excludes Eastern European urban areas from the list of potential urban areas altogether to avoid any possible biases in the estimates.[10]

Table 3 below lists the urban areas losing and gaining the most headquarters in the relocations sample. London stands out as losing a relatively high number of headquarters, although most of them have left after the Brexit referendum in 2016. Meanwhile, London (Camden, City of London, and Westminster) has overall gained the most headquarters during the time period. Among the potential urban areas, the winners in terms of net gained headquarters are Amsterdam, Dublin, Luxembourg, Vienna, and Frankfurt am Main.

Table 3: 15 urban areas losing and gaining the most headquarters

Top 15 losing HQs	Number of HQs lost	Top 15 gaining HQs	Number of HQs gained
London, UK	44 (36)	Amsterdam, NL	21
Dublin, IE	8	Dublin, IE	21
Paris, FR	8	Camden & City of London, UK	20
Zug, CH	5	Luxembourg, LU	17
Zurich, CH	5	Vienna, AT	12
Brussels, BE	5	Westminster, UK	10
Vienna, AT	4	Frankfurt am Main, DE	8
Hamburg, DE	3	Brussels, BE	7
Luxembourg, LU	3	Madrid, ES	6
Amsterdam, NL	3	Berlin, DE	4
New York, US	3	Paris, FR	3
Athens, EL	2	Barcelona, ES	3
Madrid, ES	2	Hamburg, DE	3
Dallas, US	2	City of Copenhagen, DK	3
Munich, DE	2	Hauts-de-Seine, FR	3

Note: HQs refers to headquarters. In the left-most column, London covers all inner areas of London, and Paris covers all areas of the Île-de-France region. The number of parentheses is the number of HQs lost 2016 onwards when the Brexit vote took place.

[10] The excluded Eastern European urban areas are Prague, Central Bohemian Region, Moravian Silesian Region and South Moravia Region in the Czech Republic, Budapest and Pest in Hungary, Warsaw in Poland and Bratislava in Slovakia.

Table 4 below represents the shares of industry sectors that the headquarters in the relocations sample represent. Out of the four sectors with the most relocating headquarters, manufacturing and wholesale and retail sectors have relatively fewer moving headquarters (19% and 11.2%) than their shares of the overall population dataset of headquarters (28% and 27.8%) would imply. Meanwhile, information and communication as well as financial and insurance sectors represent a relatively larger share of the moving headquarters (11.9% and 29.2%) compared to their shares of all headquarters (4.3% and 6.4%). Manufacturing as well as financial and insurance activities alone represent almost half (48.2%) of all the relocated headquarters. The high number of relocations in the finance and insurance industry after the Brexit referendum in 2016 (47.4% of relocations after 2016) seems to, however, magnify the share of financial and insurance activities. This describes the escape of headquarters from London, the center of financial activities in the UK.

Table 4: Industry composition in the relocations sample and corresponding shares in the population dataset

Industry sector	Share in relocations sample	Share in population dataset
Agriculture, forestry & fishing	1.2 %	0.7 %
Mining & quarrying	4.2 %	0.7 %
Manufacturing	19.0 %	28.0 %
Electricity etc.	0.6 %	2.1 %
Construction	1.2 %	4.6 %
Wholesale & retail trade	11.3 %	27.8 %
Transportation & storage	6.0 %	5.2 %
Accommodation & food services	1.2 %	1.3 %
Information & communication	11.9 %	4.3 %
Financial & insurance activities	29.2% (47.4%)	6.4 %
Real estate activities	0.6 %	1.6 %
Professional, scientific & technical activities	10.1 %	6.6 %
Administrative & support service activities	1.2 %	4.6 %
Education	0.6 %	0.5 %
Arts, entertainment & recreation	0.6 %	0.7 %
Other service activities	1.2 %	0.7 %
Total number of headquarters	168 (76)	50,000

Note: The share in the population dataset is the average share that the industry represents in 2013, 2016 and 2019. The numbers in parenthesis correspond to the sample of headquarters that relocated after Brexit vote in 2016.

The study of Strauss-Kahn and Vives (2009) on headquarters' relocation choices is the closest equivalent to this study and therefore offers a useful comparison point. Comparing the numbers in Table 4 to the sector composition of the moving headquarters database of Strauss-Kahn and Vives (2009) shows that relatively more headquarters in financial and insurance as well as information and communication sectors relocate in the sample of this study compared to theirs.[11] On the contrary, manufacturing as well as wholesale and trade industry sectors have relatively much more relocating headquarters in their sample than in that of this study.[12] This observation offers no definitive conclusions about the tendency of firms in manufacturing or wholesale and retail industry sectors to relocate their headquarters. Nevertheless, the numbers do seem to support the idea that firms in especially information and communication as well as financial and insurance industry sectors have become larger and more international during the last decades. The question of headquarters' location has thus become increasingly important for them as well.

In addition to the dissimilarities in the industry sector compositions, the time period and geographical context further differentiate the dataset of this study from that of Strauss-Kahn and Vives (2009). They collect data in the U.S. from 1996 and 2001, whereas the current dataset covers Europe in the 2010s. Differences in the estimation results can emerge if time, geography, and industry change the preferences of firms over their headquarters' locations. Previous studies suggest that at least firms' industries shape the way they value

[11] Strauss-Kahn and Vives (2009) categorize communication together with transportation and utilities in their study, and this category together accounts for only around 9% (8.81% in 1996 and 9.16% in 2001) of the moving headquarters. Finance, insurance and real estate sectors account for around 9.7% (9.72% in 1996 and 9.65% in 2001).
[12] In the moving headquarters database of Strauss-Kahn and Vives (2009), around 34% (33.59% in 1996 and 33.80% in 2001) of headquarters are in the manufacturing sector and around 26% (26.09% in 1996 and 25,95% in 2001) in the wholesale and retail sector.

different locational characteristics. For example, corporate income taxes and proximity to production plants weight more in the manufacturing industry sector than on average in any sector (Strauss-Kahn and Vives, 2009). Previous studies also suggest that manufacturing and retail firms have more clearly distinguishable headquarters from other units (Aarland, et al., 2007). Since the dataset of this study focuses more on industries like information and communication as well as finance and insurance, where this distinction is perhaps less clear, the results can shed light more broadly on the location patterns of all kinds of units. Most importantly, this study offers new perspectives on headquarters' location choices in contemporary Europe and among contemporary firms.

3.2. Locational characteristics

Understanding why headquarters choose to locate in certain urban areas requires data on the characteristics of these areas. This study leverages on various secondary data sources to describe European urban areas. After presenting detailed definitions of the locational characteristics highlighted in the literature review and the data sources used to measure them, this section conducts preliminary analyzes to understand how these characteristics potentially influence the location choices of headquarters.

3.2.1. Definitions and secondary data

This study focuses on the locational characteristics that previous studies back up with significant evidence. Using the geographical levels discussed earlier, the relevant characteristics are divided into three categories:

- agglomeration economies including the presence of other headquarters, support service availability and size of the educated labor pool
- urban environment including headquarters-specific wages, population size and costs of delivering headquarters tasks measured by airports and distance to other units of the same firm, and

- country environment including taxes and country conditions measured by the institutional quality and political stability.

Appendix 1 lists the sources and definitions of secondary data gathered to estimate the locational characteristics. The following chapters discuss the methods of measuring each characteristic in each category. This study combines data from multiple sources since no comprehensive database on the relevant locational characteristics is available. Fortunately, the NUTS methodology helps to consistently identify urban areas in different datasets. As mentioned earlier, the NUTS regions are, however, somewhat inconsistent due to the different methodologies that different countries use to measure them. Using higher NUTS levels (NUTS 2 or NUTS 1 instead of NUTS 3) alleviates this issue because the regions then compare better to each other in size. Thus, due to the availability of data or needed adjustments to increase consistency and comparability to real life, this study measures most of the locational characteristics at the NUTS 2 level. The headquarter agglomeration variables are the only exceptions based on valid reasons explained next. Also, country-specific characteristics are naturally measured at the country level.

The first category of location characteristics consists of agglomeration economies. The number of headquarters in the urban area under study, measured at the most detailed NUTS 3 level, defines the agglomeration of headquarters. As pointed out in earlier studies, headquarters agglomerate because of their need for face-to-face interactions to exchange information. This argues for measuring the number of headquarters in a more limited area. This study measures both the total number of headquarters in any industry and the number of same NACE industry headquarters.[13]

The second agglomeration economy characteristic expresses the availability of support services or, more exactly, the relative specialization in support services

[13] Strauss-Kahn and Vives (2009) also measure the specialization of a location in the headquarters' industry, but this study ignores it due to a lack of detailed enough data.

in an urban area. This study calculates the specialization measure using the same method as Strauss-Kahn and Vives (2009) that divides the share of support service employment in the specific urban area by the share of support service employment overall in Europe.[14] The specialization measure tells more than the plain support service employment level by allowing to identify locations with relatively higher support service availability than others. The most detailed data available maps support services at the NUTS 2 level, which means that this study measures the support service availability in a larger area around the urban area where the headquarters is. Although the theories on agglomeration economies argue that face-to-face interactions are important when utilizing support services, interactions at a distance are presumably possible in some activities nowadays. Therefore, it is realistic to assume that headquarters use the support services available in the whole NUTS 2 region that surrounds the urban area where they are located.

Measuring the third agglomeration economy arising from labor pools as the share of the labor force (25- to 64-year-olds) with tertiary education is in line with previous studies. This study measures these educated labor pools at the NUTS 2 level. This aligns the data well with reality because the level of education attained does not usually drop dramatically outside the borders of urban areas and because headquarters attract workers from a larger region around urban areas.

Characteristics of urban environments form the second category of locational characteristics in this study. Headquarters-specific wage is, as indicated by its name, the hourly compensation paid by employers to employees in headquarters-type activities in a specific urban area. This compensation refers to the total remuneration including cash, benefits, and social security contributions. As support service data, the wage data is only available at the NUTS 2 level. It is reasonable to assume that wages are similar enough in a

[14] As a reminder, this study defines Europe as EU-28 countries plus Norway and Switzerland.

NUTS 2 region because workers are mobile within the area and their movements to better-paying jobs would even out major wage differences in the long term.

The second characteristic of the urban environment is the population size that acts as a proxy for congestion. To increase the consistency in size among urban areas in the data, this study measures the population size at the NUTS 2 level.[15] At this NUTS level, the largest urban areas such as Paris and London represent one area and the population of smaller urban areas is that of a larger area around them (for example, the population in Barcelona refers to that of the Catalonia region). This methodology could raise questions about its ability to truthfully measure congestion effects if an inner urban area with higher congestion was combined with a region surrounding it with lower congestion (as these two areas would together constitute a NUTS 2 region). On the contrary, combining areas with similar congestion levels does not cause the same issue. As this study includes only two of these risky cases among all 83 potential urban areas, namely Munich and Munich district as well as City of Copenhagen and Metropolitan Copenhagen, the concern is presumably not major enough to interfere the analysis.

Costs of delivering headquarters tasks also characterize the urban environment in this study. More specifically, the availability of airports and the distance to other units of the same firm define how costly it is for headquarters to deliver their tasks. As Strauss-Kahn and Vives (2009), this study divides available airports into three size categories (large, medium, and small airports) and

[15] As an exception, the population in NUTS 2 regions belonging to London is replaced by the population of their common NUTS 1 region that refers to the metropolitan London. This adjustment is relevant because the NUTS methodology splits London into smaller parts than other comparable urban areas. While the metropolitan London represents a NUTS 1 region and its sub-areas represent NUTS 2 regions, for example Île-de-France (the metropolitan area around Paris) is a NUTS 2 region. Thus, London now corresponds better to other similar urban areas in Europe.

measure the availability with a dummy variable for each size category.[16] This dummy is equal to 1 when an airport of the specific size is available and 0 otherwise. Since several airports are available, especially in larger urban areas covering several NUTS 3 regions, it is more realistic to measure the airport availability at NUTS 2 level.[17] Consequently, this study counts the air transport from all airports in the same NUTS 2 region together when defining the size category of airport facilities in an urban area.

The distance variable is similar to that of Strauss-Kahn and Vives (2009), measuring the straight-line distance from the headquarters' original urban area to the destination urban area. This method assumes that other units of the same firm are located in the original urban area. Measuring the average distance between the destination urban area and all units with whom a headquarters interacts would give an accurate estimate of distance for calculating the costs of delivering headquarters' tasks. Such a method would, however, require identifying the locations of these units for each headquarters using data that this study lacks access to. Therefore, this study assumes that the previous location either hosts other units of the same firms with whom the headquarters interacts or offers good connections to them. Moving away from that location thus increases the distance to these units and the costs of delivering headquarters' tasks.

All tax rates are naturally measured at the country level. The corporate income tax rate is the percentage that firms pay on their profits accumulated in the country in question. The labor income tax rate is the one that the person earning the average wage pays on his or her income. Using this employee-borne labor income tax rate is meaningful because Egger at al. (2013), whose study is the only other one measuring the importance of labor taxation in headquarters

[16] The share of total passengers in Europe that large, medium and small airports transport are more than 1%, 0.05-1% and less than 0.05%, respectively.
[17] For example, the Île-de-France region hosts five airports of which at least Paris-Charles de Gaulle and Paris-Orly are intensively used for international air travel. However, they are located on different NUTS level 3 regions.

location choices, use the same methodology. They highlight the progressivity of labor income taxes and employer social security contributions as other important elements of labor taxation. Due to the lack of appropriate data, this study ignores the progressivity of labor income taxes. Additionally, this study does not focus on employer social security contributions separately to avoid duplication since the wage variable already covers these contributions.

In addition to taxes, headquarters consider the quality of institutions and political stability as relevant country-level conditions influencing their operations. The data source used in this study measures political stability as an average measure of scores in government stability, internal and external conflict as well as ethnic tensions. In line with Valentino et al. (2019), this study measures institutional quality using indices on the levels of corruption, law and order as well as bureaucracy quality. Thus, the measure of country conditions is a score between 28 (the sum of four scores with maximum values 12, 6, 6 and 4) and 4 (minimum value of each score is 1). A higher score indicates better conditions, meaning better institutional quality and a more stable political environment.

3.2.2. Descriptive analyses and expected influences on location choices

Table 5 below compares the mean values of locational characteristics among chosen urban areas to those among all potential urban areas that headquarters consider in this study. The discussion below leverages on the results of previous studies and the values in Table 5 to explain the relation that each locational characteristic is expected to have with headquarters' location choices. Scatterplots of the number of headquarters compared to the values of specific locational characteristics in potential urban areas support this analysis.[18] The nature of the empirical model makes it difficult to conclude anything definitive

[18] Since this study measures the number of headquarters in 2013, 2016 and 2019, I collect data on the locational characteristics and form the scatterplots using observations from only these three years. Thus, each scatterplot consists of 249 observations (83 possible urban areas times three time points).

from these descriptive analyses. Nevertheless, they are useful in understanding what the urban areas look like on average, which characteristics most clearly distinguish chosen urban areas from all potential ones and whether major outliers exist.

Table 5: Comparison of chosen and all potential urban areas

Locational characteristic	Chosen urban areas	All potential urban areas
HQs overall	451.07 (397.5)	290.08 (313.4)
HQs in the same industry	60.61 (71.24)	32.76 (52.66)
Support service availability	1.78 (0.573)	1.31 (0.477)
Educated labor pool	0.45 (0.124)	0.38 (0.102)
HQ-specific wage	32.55 (7.267)	28.15 (9.225)
Population size (millions)	4.27 (3.153)	4.18 (3.400)
Large airport	0.45 (0.499)	0.20 (0.398)
Medium airport	0.50 (0.501)	0.56 (0.496)
Distance (kilometers)	1958.85 (2857.9)	2309.61 (2991.3)
Corporate income tax rate	0.23 (0.0668)	0.28 (0.0735)
Labor income tax rate	0.29 (0.0602)	0.30 (0.0666)
Country conditions score	23.16 (1.700)	21.86 (1.896)
Number of headquarters	168	12607

Note: Mean coefficients, standard deviation in parenthesis. 168 corresponds to the number of cases in the relocations sample and 12607 to the number of all potential urban areas in each case (83*168) minus the potential urban areas in the same country as the original urban area for each case (only cross-border relocations are considered).

Economic geography theories strongly suggest that agglomeration economies from other headquarters, support services, and pools of highly skilled labor attract headquarters. Previous empirical evidence supports these theories,

although evidence on the influence that educated labor pools have on headquarters' location choices on their own is mixed. The presence of high-skilled labor rather implies that other agglomeration economies are present too.

The comparison of means between chosen and all potential urban areas in Table 5 supports the positive relationship between all agglomeration economies and headquarters' location choices. Indeed, chosen urban areas have higher mean values for all the agglomeration economy characteristics. For example, the average urban area among those chosen by headquarters hosts 161 more headquarters overall and 28 more headquarters in the same industry than the average urban area in the whole sample. In terms of percentages, these correspond to 55% and 85% more headquarters, respectively. Meanwhile, the average service availability index is 36% higher among chosen urban areas than among all potential urban areas. The standard deviations show, however, that especially the number of headquarters varies within a large scale among both chosen urban areas and potential urban areas overall. This observation implies that large differences exist even among chosen urban areas and that the descriptive data says nothing conclusive about the influence of headquarters' agglomeration. As the scatterplots presented below show, some outlier urban areas like Paris, Madrid, Barcelona, and London all hosting more than a thousand headquarters create noise in the data.

The theoretical reasoning in previous studies often sees wages as a measure of congestion, increasing the costs for headquarters who need to compensate employees for higher living costs. These studies thus argue that wages are negatively associated with headquarters' location choices. There are, however, clear inconsistencies in the empirical implementations to prove this influence. While some studies ignore agglomeration economies and consequently risk having biased wage estimates (e.g. Egger et al. (2013) and Belderbos et al. (2017)), others measure the general wage level (e.g. Strauss-Kahn and Vives

(2009) and Bel and Fadega (2008)).[19] This study argues that measuring headquarters-specific wages simultaneously with agglomeration economies is essential for obtaining a truthful estimate of the importance of wages in headquarters' location choices.

Two previous studies using a similar methodology, conducted by Davis and Henderson (2008) and Henderson and Ono (2008), get mixed results concerning the influences of wages in headquarters' location choices. Henderson and Ono (2008) suggest that the positive influence could demonstrate the high skills of headquarters' employees that countervail the wage costs. The descriptive analyses of wage data suggest that headquarters-specific wages capture these high skills of employees instead of the detrimental congestion costs in this study. Thus, the results are likely to build on the idea introduced by Egger et al. (2013) that the importance of wages in headquarters' location decisions decreases when high-skilled labor is available. The higher mean value of headquarters-specific wages in chosen urban areas compared to all potential urban areas in Table 5 supports the argument for the positive influence. The 4.4-euro difference in the headquarters-specific hourly wage amounts to a difference of 762.7 euros in monthly wages between chosen and all potential urban areas. Figure 1 also shows that the amount of headquarters in urban areas gradually increases with headquarters-specific wages (when outlier observations are ignored). It seems that higher headquarters-specific wages make an urban area somewhat more attractive for headquarters since they need labor that is highly skilled in their operations and the wage level rises with the skills level of workers.

[19] A biased wage estimate means that it captures the availability of labor employed by other headquarters and support services when agglomeration economies are excluded.

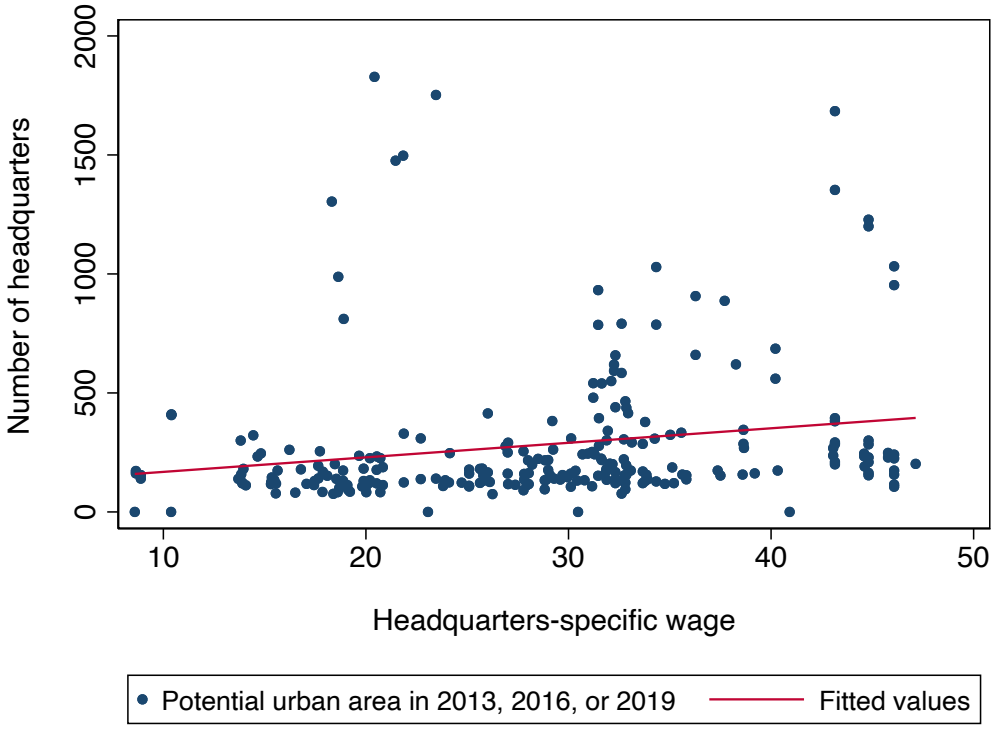

Figure 1: Number of headquarters compared to headquarters-specific wage

This study aims to proxying the congestion costs in the urban environment with the population size. Earlier evidence on how the population size influences headquarters' location choices is rather inconsistent. Therefore, it is difficult to argue for any specific implications that a larger population in an urban area should have. Table 5 shows that chosen urban areas are very close to the whole sample of urban areas in terms of average population sizes, both groups having around 4 million inhabitants on average. Also, the standard deviations in both groups are large. Consequently, predicting the influence that population sizes should have on headquarters' location choices is increasingly difficult. Figure 2 below suggests that the relationship between the number of headquarters and the population size is positive. However, it seems that a group of outliers in the upper right corner of the graph tilts the line upwards. If this study succeeds in proxying congestion in an urban area with its population size, the influence on headquarters location choices is negative. This is possible if headquarters in the relocations sample have not chosen the outlier urban areas.

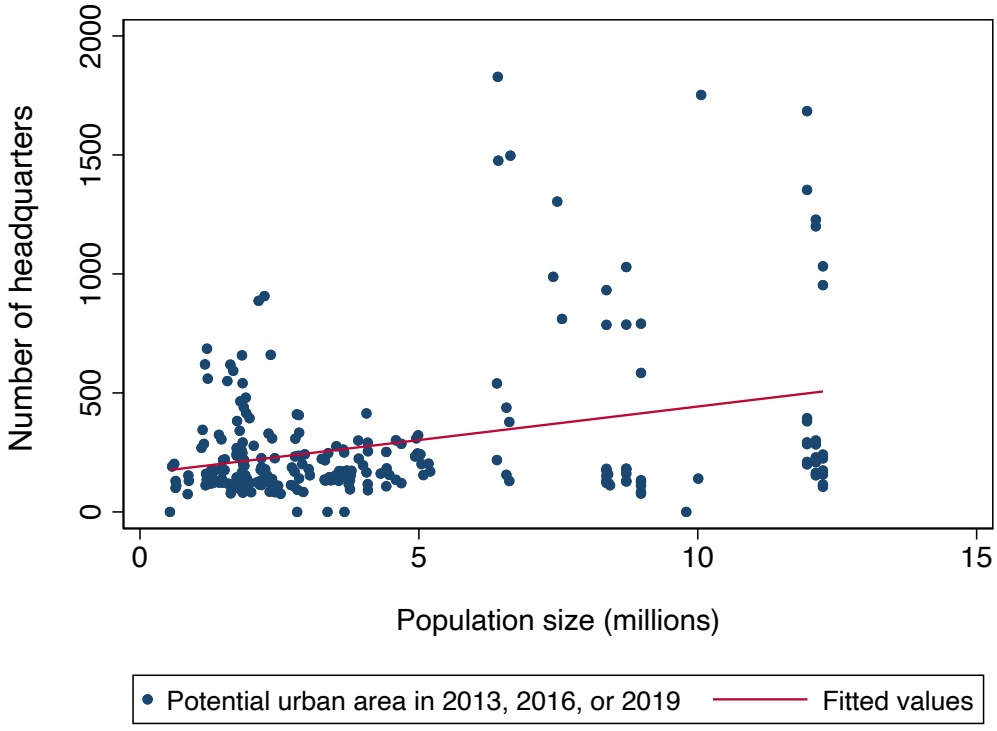

Figure 2: Number of headquarters compared to population size

Headquarters tend to, as earlier theories and empirical results suggest, prefer urban areas with good airline connections and that are the closest possible to other units of the same firm to minimize the costs of delivering their tasks. Thus, the availability of airports increases the attractiveness of urban areas for headquarters, while the longer distance to other units decreases it. The comparison of means in Table 5 supports these suggestions and points towards two observations. First, the standard deviations in distance among both chosen and all potential urban areas are large and most likely created by the 30 relocations from other continents to Europe in the relocations sample. The comparison of means presumably still speaks for the importance of minimizing distances because these relocations from other continents simply compare larger distances to each other.

Second, an especially clear difference arises in the availability of large airports between chosen urban areas and all potential urban areas. Table 5 suggests that 45% of the chosen urban areas host a large airport, compared to 20% of all

potential urban areas. The lower mean availability of medium airports in chosen urban areas does not argue against the importance of airports since their connections might not be sufficient, especially for headquarters whose subunits are numerous or geographically spread out. Figure 3 below shows that the majority of airports in potential urban areas transport less than 30 million passengers a year, but a higher amount of headquarters seems to correspond positively with transporting more passengers. Therefore, large airports seem to influence location choices of headquarters positively and long distances to other units to influence them negatively.

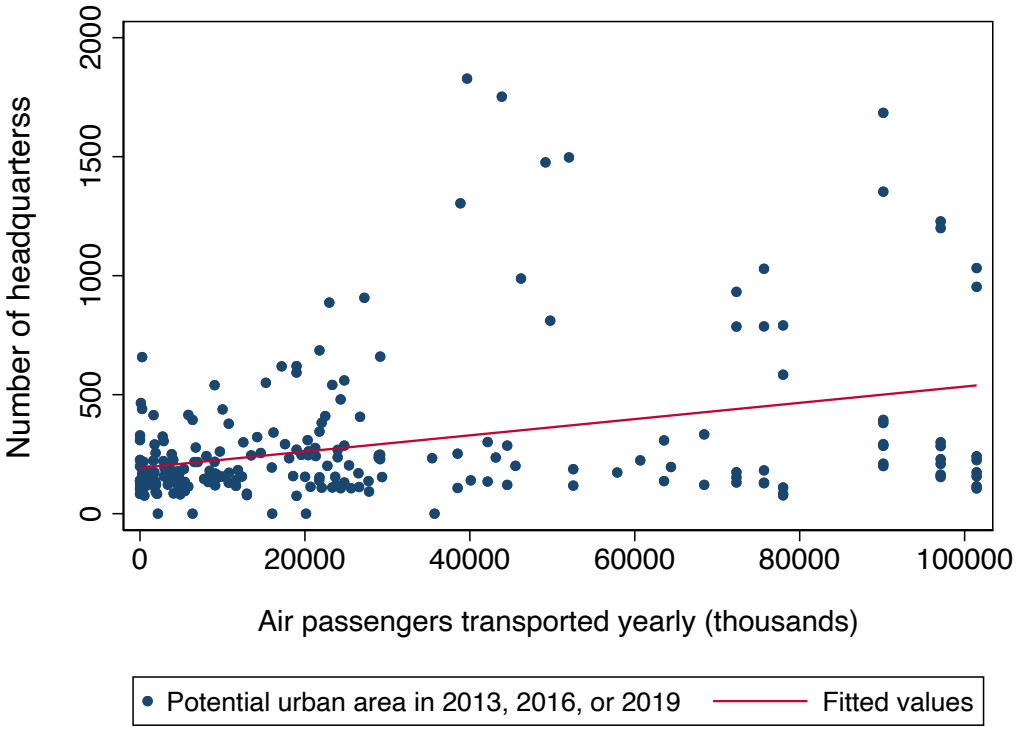

Figure 3: Number of headquarters compared to air passengers transported
Note: Large airports transport on average 46 million passengers yearly.

As for the country environment, both theories and earlier empirical evidence strongly suggest that higher taxes reduce the attractiveness of urban areas for headquarters. As intuitive logic also implies, higher corporate income tax rates decreasing profits directly are disadvantageous for firms. Higher labor income taxes both affect firms' profits indirectly by reducing the level of effort that their employees are ready to exert and reduce the availability of high-skilled

employees who see higher taxation as unattractive. Meanwhile, better institutions and a more stable political environment increase the attractiveness of an urban area in the eyes of headquarters based on earlier evidence.

The mean values of chosen urban areas in Table 5 are lower for taxes and higher for the country conditions score compared to all potential urban areas, which supports the expectations about negative influences of taxes and positive influences of institutions and political stability. While there is only a one-percentage-point difference in labor income tax rates between the average urban area among the chosen ones and all potential ones, the corporate income tax rate is 5 percentage points lower in the former. Since both tax rates vary within similar standard deviations, a larger difference in mean corporate income tax rates suggests that they are relatively more important for headquarters. The difference in average country conditions scores as well as the standard deviations are rather small, indicating that the European urban areas in the sample are overall very similar in terms of institutional quality and political stability.

4. Empirical methodology

The variety of methods used for studying the location patterns and choices of headquarters is as vast as that of the different perspectives taken. Therefore, a careful selection of the right method based on the standpoint of this study is in order. After comparing available methodologies and justifying the choice of nested logit as the empirical model of this study, this section unveils the details of the model taking into account the current research context, specifies the exact equation that the empirical part estimates and presents the key endogeneity issues.

4.1. Available empirical methodologies

Some crucial differences arise between the empirical methodologies used for studying topics related to the location patterns and choices of headquarters. The following subsection compares these methodologies and highlights the key differences. After, the next subsection explains why the discrete choice models are in general the appropriate choice for studies on the location choices made by firms and which differences make the nested logit the most suitable discrete choice model for this study.

4.1.1. Previous empirical studies

Comparing the research questions and methods of previous empirical studies helps to find the studies with the most comparable research settings to that of this study. To make the comparison easier, this subsection categorizes previous studies on headquarters' locations choices into three groups: 1) those studying which locational characteristics firms consider when choosing a location for their headquarters (i.e. where to (re)locate), 2) those studying which locational characteristics induce the decision to relocate headquarters away from the current location (i.e. whether to relocate), and 3) other miscellaneous topics. Table 6 below describes the studies in categories 2 and 3.

The first three studies in Table 6 take slightly different perspectives to studying what makes a firm relocate its headquarters away from the current location. Klier (2006) studies more broadly how several locational characteristics affect the probability that a firm decides to relocate its headquarters. Meanwhile, Voget (2011) and Valentino et al. (2019) focus on studying the influence of certain locational characteristics on the probability of relocating headquarters, which are tax policies and institutional quality, respectively. All of these studies use logistic regression meaning that their dependent variable is a binary probability variable that is equal to 1 when the headquarters is relocated and 0 when it is not. The locational characteristics enter the regression equation as independent variables. This methodology offers a simple way to study which characteristics of the current location induce the decision to relocate headquarters away from there. However, it does not allow comparing locations based on their characteristics, which is essential for understanding where the headquarters then ends up being relocated.

Table 6: Studies on the decision to relocate headquarters and other topics

Study	Method used	Research question*
Klier (2006)	Logistic regression	Which city characteristics influence HQ's probability of moving?
Voget (2011)	Logistic regression	How do tax policies influence the HQ's decision to move abroad?
Valentino et al. (2019)	Logistic regression	Does institutional quality in the host country play a role in HQs' decision to relocate?
Lovely et al. (2005)	Regression analysis	Are information needs associated with the spatial concentration of exporting HQs?
Bel & Fageda (2008)	OLS and 2-step GMM estimations	Do high-quality transportation facilities attract HQs?
Davis & Henderson (2008)	Poisson	What characteristics of economic bases attract HQ agglomeration?
Henderson & Ono (2008)	Multinomial logit, OLS and IV estimations	How important is proximity to plants compared to access to inputs and services in HQ's location choice?

*Formulated based on the paper

The last four studies in Table 6 form category 3 of miscellaneous topics. The empirical methodologies of Lovely et al. (2005), Bel and Fadega (2008), Henderson and Ono (2008) and Davis and Henderson (2008) do not offer generally useful guidance for studying the location choices of headquarters due to the specific nature of their research questions and settings. Therefore, this chapter does not go into the details of their methodologies. The dependent variable most essentially differentiates the estimations conducted by Lovely et al. (2005) and Bel and Fadega (2008) from the studies estimating the probability of relocating. Instead of using a binary probability variable, they regress the number of headquarters in a location against several locational characteristics. Davis and Henderson (2008) measure the influence of locational characteristics on births of headquarters in a certain area. The key difference between these studies compared to the current one is the perspective of the location taken to the topic. In other words, they measure how many headquarters are present or born in a location characterized by certain attributes. This perspective would naturally require a very different dataset from what this study uses.

Table 7 below represents the earlier studies offering the closest comparison point to this study. All of these studies take the perspective of a firm, and their empirical methodologies thus estimate the location choices made by firms. They use different variations of the discrete choice model, namely conditional, mixed and nested logit models, as well as combinations of them. While any discrete choice model is per se suitable for studying choices of individuals firms, the variations have crucial differences regarding their embedded assumptions. As the next section explains, these assumptions form the basis for comparing different discrete choice models and thus choosing the right one in regard to the research setting in question.

Table 7: Studies on the location choices of headquarters

Study	Method used	Research question*
Strauss-Kahn & Vives (2009)	NL, CL for a checkup	What locational characteristics define where HQ moves?
Laamanen et al. (2012)	CL, NL, and ML as alternatives	Which factors push and pull HQs from one location to another?
Egger et al. (2013)	CL, NL as an alternative	How does labor taxation influence HQ location decisions?
Belderbos et al. (2017)	ML, CL for a checkup	What global city characteristics determine where HQs are located?

Note: NL, CL, and ML refer to nested, conditional, and mixed logit, respectively.
*Formulated based on the paper

4.1.2. Comparison of discrete choice models

The discussion above demonstrates that only a few earlier economic geography studies focusing on the concept of headquarters' location compare to the current one because they focus on the actual location choices made by firms. Among these studies, discrete choice models are the prevailing methodology for a reason. A discrete choice model is a natural choice for studies whose data entails information relating to firms' location choices and who take the perspective of a firm making the location choice. In this case, the marginal effects of location-specific explanatory variables reflect how variations in the values of these variables influence the probability that a firm chooses a location. (Arauzo-Carod, et al., 2010).

The studies listed in Table 7 use conditional, nested, and mixed logit models that are all variations of the discrete choice model. All of these logit models are suitable for modeling location choices but they differ in a few crucial aspects. First of all, the mixed logit model differs from conditional and nested logit in the sense that it perceives individuals in the sample as heterogeneous. The heterogeneity causes differences in their preferences over the locational characteristics. The study of Belderbos et al. (2017) represents a good example of a situation where heterogeneity matters. They theorize that regional headquarters have different roles in their organizations and therefore need different locations to execute their tasks best. While the heterogeneity does not

prove significant for most locational characteristics, Belderbos et al. (2017) do find that regional headquarters are significantly heterogeneous when it comes to their connectivity needs.

A mixed logit model could fit this study since the dataset covers both corporate and intermediary (regional and divisional) headquarters, which can differ in their preferences over different locational characteristics. However, the main focus is not to study the differences in preferences among different types of headquarters. Therefore, the mixed logit model is ruled out as an excessively complicated methodology, and this subsection focuses on comparing conditional and nested logit models.

Secondly, crucial difference among discrete choice models is the way relative changes in the number of headquarters in different locations are incorporated. The conditional logit model considers a zero-sum world where the same amount of firms that one location gains must disappear from other locations in the dataset. A nested logit model, on the contrary, lays in between a zero-sum and a positive-sum world (in which amounts of firms in other locations do not change when one location gains more firms). Some of the firms relocating to one location disappear from other locations in the dataset, but also new firms appear from locations that are not covered in the dataset. (Schmidheiny and Brülhart, 2011).

The last and maybe the most crucial difference concerns the two model's interpretations of the independence of error terms, referring to the assumption of independence from irrelevant alternatives (IIA). The IIA assumption implies that the ratio of probabilities between any two choice alternatives is independent of the attributes or the existence of all other alternatives (Train, 2002). This assumption is likely to fail in situations where some unobserved components among alternatives are correlated because the alternatives are close substitutes to each other. The conditional logit model assumes that IIA holds across all alternatives, which makes it unsuitable for research settings where these substitute alternatives exist. A nested logit model is better for such

settings because it divides alternatives into differentiable nests and allows for correlation between alternatives within the same nest. The IIA assumption thus holds within each nest but not for alternatives in different nests (Train, 2002).[20] An example nested logit model could divide alternatives into nests based on their geographic regions, indicating that alternatives belonging to the same region are close substitutes to each other.

The IIA assumption means that substitution across alternatives is proportional and the probabilities of alternatives sum up to one (Train, 2002). In practice, this means that when a firm excludes an option from nest A, the probability of choosing another alternative in nest A increases relatively more than the probability of choosing an alternative in nest B. This happens because the probabilities of alternatives in nest A sum up to one and the ratio of probabilities among alternatives in nest A is independent of the existence of alternatives in nest B.

Based on these characteristics, the nested logit model fits this study the best. The dataset contains firms' relocation events, which makes it optimal for studying the location choices from the perspective of firms. The relocation events represent neither a zero-sum nor a positive-sum world but rather something in between. While relocations within Europe imply that one European urban area gains a headquarters at the expense of another European urban area, some firms also relocate from other continents to Europe. Also, some urban areas in Europe are close substitutes to each other based on, for example, the European region they belong to. For instance, Paris and Brussels are closer substitutes to each other based on their European region than Paris and Helsinki. This implies a correlation in the unobserved components of the Paris and Brussels alternatives. Using a conditional logit would fail to take into account the

[20] Allowing correlation among some alternatives is possible since the unobserved components of all alternatives are jointly distributed to a generalized extreme value, leading to a specific structure of the estimation error term. This is a common property of all generalized extreme value models. (Train, 2002).

possible correlation of unobserved components by comparing Brussels, Paris, and Helsinki simultaneously.

4.2. Empirical strategy

As the last section explicates, the nested logit model is the appropriate empirical method for this study. The following subsections apply it in the current context, specify the equation it estimates and unveil the endogeneity issues that arise when the model is applied in the research context of this study.

4.2.1. Nested logit model in the current context

This study applies a two-level nested logit model where the upper level refers to choosing a nest, and the lower level refers to choosing a specific urban area within the chosen nest. The choice process starts after the headquarters has already chosen to relocate. Figure 4 illustrates a headquarters' location choice according to these two levels. Such an approach does not conflict with reality since firms tend to first narrow down the sample of alternatives based on some important criteria (such as region or major language) and then choose one location among these alternatives. In the case of Netflix, the company first shortlisted Amsterdam, London, and Dublin, all located in Western Europe, as attractive locations before choosing Amsterdam as the new location for its European headquarters (Invest in Holland, 2019).

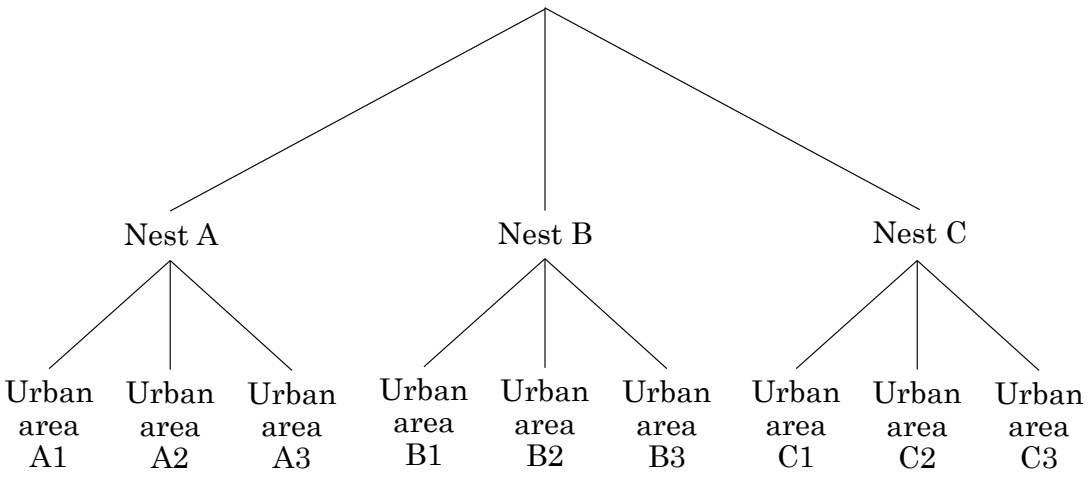

Figure 4: An example tree diagram modeling the location choice process

This study distinguishes between three kinds of nested structures: the first configured based on the level of population in the urban area, the second based on the European regions that the urban area belongs to, and the last one based on the official language spoken. Appendices 2, 3, and 4 list urban areas by nests in these three nesting structures. The urban areas are categorized based on the following population thresholds: more than 3 million, 3 to 1 million, 1 million to 500,000, and less than 500,000. The regions are Northern, Western, Central, and Southern Europe (StAGN, 2007). The official language is the language of the country or the region in a multi-language country. Based on the urban areas present in the dataset, the language nests are German-, Romance- (French, Spanish, Italian), English-, Dutch- and Nordic-speaking. Potential urban areas hosting more than 100 headquarters (as defined in section 4.2.) constitute the alternatives in each nest.

These nesting structures follow those used by Strauss-Kahn and Vives (2009), except that this study adds language nests as a new feature. Using language nests is naturally not possible in their study that concerns metropolitan areas in the U.S. The nesting model must be aligned with the idea of substitutability between urban areas embedded in the nested logit methodology. If two urban areas are, based on some defined characteristics, closer substitutes to each other than to a third urban area, they belong to the same nests and the third urban area to a separate nest. This study formulates the three nesting models based on relevant characteristics defining substitutability between urban areas. The nesting models are also aligned with reality since it is natural for headquarters to have preferences over the size, region, or language of the urban area where they want to locate. Therefore, the decision process can logically entail first choosing a certain group of urban areas fulfilling certain size, region, or language criteria and then making the final decision among the alternatives in this group.

In general, several studies have proved that the nested logit is consistent with utility maximization. The utility from choosing an alternative decomposes into

observable parts and a random variable that is unobserved by the researcher. (Train, 2002). The two-level nested logit model of this study treats this utility as the value that a firm t obtains in a location i that belongs to a nest k and decomposes it into parts in the following manner:

$$V_{ti} = \alpha Y_{tk} + \beta X_{ti} + \varepsilon_{ti}$$

The first part represents the headquarters' choice of a population, region, or language nest, where Y_{tk} is a vector of variables that describe the nest k. The variables in this vector vary over different nests but not within each nest. The second part refers to the headquarters' choice of an urban area i conditional on having chosen the nest k, where X_{ti} is a vector of variables describing the urban area i. These variables vary only over the different urban areas within nest k. ε_{ti} is the specific error term for firm t in location i that is independently and identically extreme value distributed.[21] The vectors Y_{tk} and X_{ti} consist of variables that influence the firm's profits including the agglomeration of headquarters, support services, labor pools, costs of delivering headquarters tasks, headquarters-specific wages, corporate and labor income taxes as well as country conditions. All of these variables are observable in the population-, region- and language-nested levels (upper level of the nested structure) as well as in the urban area level (lower level of the nested structure).

The nested logit model estimates the determinants of the probability that a firm chooses in a specific European urban area for its headquarters, which results from the fact that its profits are maximized there. This probability of locating in an urban area is the product of two probabilities: the probability of choosing an alternative in the nest k (upper model) and the probability of choosing an urban area i conditional on having chosen to relocate to nest k (lower model).

[21] When the error terms of all alternatives are extreme value distributed jointly, they become a generalized extreme value. This is the key property of generalized extreme value models, including the nested logit model, that allows for correlations among some alternatives. (Train, 2002)

Therefore, the probability that a firm t locates in an urban area i, marked P_{ti}, is expressed as

$$P_{ti} = P_{tk} * P_{ti|k}$$

where P_{tk} is the upper model probability and $P_{ti|k}$ is the lower model probability. More specifically, the lower model is expressed as

$$P_{ti|k} = e^{X_{ti}/\lambda_k} \Big/ \sum_{j=1}^{N_k} e^{X_{tj}/\lambda_k}$$

where $N_k \in k$ is the number of alternatives in nest k.

The upper model depends not only on the nest-level characteristics but also on urban area-level characteristics defined in the lower model. Therefore, an inclusive value I_{tk} that links the upper and lower models by bringing information from the lower model into the upper model is needed. More specifically, inclusive value is the log of the denominator of the lower model:

$$I_{tk} = \ln \left(\sum_{j=1}^{N_k} e^{X_{tj}/\lambda_k} \right)$$

Thus, the upper model is expressed as

$$P_{tk} = e^{\alpha Y_{tk} + \lambda_k I_{tk}} \Big/ \sum_{j=1}^{K} e^{\alpha Y_{tj} + \lambda_j I_{tj}}$$

with K as the overall number of nests. In this equation, $\lambda_k I_{tk}$ denotes the expected value that a firm t receives from choosing among the urban areas in

nest k.[22] By substituting the nested logit choice probability function into a log-likelihood function, the parameters of the model can be estimated with standard maximum log-likelihood techniques (Train, 2002).

The parameter λ_k is central in the nested logit estimation since it measures the degree of independence in the unobserved components of alternatives in nest k (varies between 0 and 1) and therefore, the relevance of the nested structure. In statistics, it is generally called the dissimilarity parameter. When the value of λ_k increases, the alternatives are more dissimilar and there is more independence among their unobserved components. This means that the relevance of the nested structure decreases. When $\lambda_k = 1$, the unobserved components are completely independent, and the estimation is equivalent to a conditional logit estimation. This study allows the dissimilarity parameter to vary between different nests to see more in detail how well the nesting structure works. This means that the correlation among unobserved components can differ across nests (Train, 2002).

4.2.2. Empirical specification

This study measures the value of a location i for a firm and its headquarters based on the following equation:

$$\ln v_i = \beta_1 \ln T_{1i} + \beta_2 c_{1i} + \beta_3 \ln c_{2i} + \beta_4 \ln w_i + \beta_5 \ln p_i + \beta_6 \ln a_{1i} + \beta_7 \ln a_{2i}^k + \beta_8 \ln s_i + \beta_9 \ln T_{2i} + \beta_{10} \ln r_i + \epsilon_i \quad (4.1.)$$

where T_1 is the corporate income tax rate, c_1 is the airport availability, c_2 is the distance between headquarters and other units of a same firm, w is the headquarters-specific wage, p is the level of population, a_1 is the total number

[22] In practice, one could interpret that the choice of a nest depends on the expected value received from that nest. This value composes of the value that accumulates in any urban area of that nest, which is Y_{tk}, and the expected additional value accumulating from being able to choose the best alternative within the chosen nest, which is $\lambda_k I_{tk}$.

of headquarters, a_2^k is the number of headquarters in the same NACE industry k, s is the support service availability, T_2 is the average labor income tax rate and r is the country conditions score. This study uses a labor variable as a control variable in more detailed analyses. All of these variables are specific to a location i. β is the estimated coefficient specific to each variable. $v_i = 1$ if the firm's profit is maximized in location i, reflecting the fact that the firm locates itself there with certainty, and otherwise $v_i = 0$.

Transforming the variables on both sides of the equation (4.1.) using natural logarithm makes interpretation of the results more straightforward. This transformation is done for all but airport availability variables that are in dummy format. Table 8 below summarizes all variables based on the number of observations, means, standard deviations as well as minimum and maximum values.

Table 8: Summary statistics of estimated variables

Variable	Obs.	Mean	Std.Dev.	Min	Max
ln_corporate income tax rate	12607	-1.32	.28	-2.079	-.811
Large airport	12607	.197	.398	0	1
Medium airport	12607	.562	.496	0	1
ln_distance	12607	7.081	1.104	3.343	9.808
ln_HQ-specific wage	12607	3.276	.37	2.102	3.853
ln_population size	12607	1.128	.776	-.726	2.505
ln_HQs overall	12607	5.316	.839	1.099	7.511
ln_HQs in the same industry	12607	2.608	1.431	0	6.315
ln_support service availability	12607	.21	.346	-.638	1.156
Educated labor pool	12607	.376	.102	.118	.748
ln_labor income tax rate	12607	-1.243	.223	-2.095	-.848
ln_country conditions score	12607	3.081	.087	2.887	3.287

Note: Educated labor pool is a control variable. For urban areas that have zero headquarters in the same industry, the amount is adjusted to 1 since this does not make a difference in the analysis but enables taking a natural logarithm of all values. Thus, the minimum value of ln_HQs in the same industry is 0 (i.e. natural logarithm of 1).

Equation (4.1.) reflects the discussion of the theories and findings of previous studies. It is essentially similar to that specified by Strauss-Kahn and Vives (2009), ensuring the comparability of our estimation results. Some small differences arise based on the included variables and their format. This study excludes the agglomeration variable for the same industry employment due to the lack of appropriate data while adding variables for labor income tax rate and country conditions as studies after Strauss-Kahn and Vives (2009) emphasize their importance. Furthermore, the corporate income tax rate T_1 enters the equation directly instead of $1 - T$ format, and the support service variable accounts for both business and financial services instead of measuring these two separately.

The analyses in section 3.2.2. sets forth the expected influences of each locational characteristic that translate to the expected signs for variables in equation (4.1.). This study expects to find positive signs for variables measuring headquarters-specific wages, airport availability, all agglomeration economies, and country conditions. On the contrary, the signs for both tax variables and the distance variable are likely to be negative. If this study succeeds in proxying the congestion effects, the estimations return a negative sign for the population variable. The crucial difference to Strauss-Kahn and Vives (2009) is the positive sign expected for the wage variable. This expectation arises from measuring the wage level in headquarters-type activities instead of the general one.

4.2.3. Endogeneity issues

There are two types of endogeneity issues that require attention when answering the research question of this study. First of all, some explanatory variables in the regression might be endogenous. This is the case with, for example, support services since the relocation of headquarters to an urban area might induce the establishment of more support services there. Also, some unobserved location- and time-specific factors that concern all headquarters, such as a tax subsidy, might cause the relocation of multiple headquarters to a specific location during the same time period. Aiming to escape or at least

reducing the implications of this endogeneity issue, this study usea lagged values for all the locational characteristics. Consequently, headquarters make their location choice based on the values of the year before the relocation took place. Although this strategy does not guarantee that the explanatory variables become purely exogenous, it is in line with methodologies in previous studies (e.g. Strauss-Kahn and Vives, 2009).

The other kind of endogeneity issue arises from possible omitted variables that affect both the decisions to locate headquarters in an urban area in the current period and the presence of headquarters, support services, and labor in that urban area in earlier periods. These omitted variables can be location-specific attributes or macroeconomics shocks that persist through time and their influences could be controlled by location-specific fixed effects. Since measuring country-fixed effect is not possible simultaneously with the essential country-level variables in the analysis, this study does not introduce them. Instead, remarks on the possible biases that these omitted variables can impose on the estimation results are provided when they are relevant.

5. Estimation results

Before going through the estimation results, it is useful to clarify some key issues related to the interpretation of the result tables. The dissimilarity parameters are an essential part of the nested logit model since they measure the degree of independence in the unobserved components of alternatives in the same nest. The lower the value of a dissimilarity parameter, the better the nested logit fits the data. As mentioned before, this study estimates the dissimilarity parameters separately for all nests. Table 9 below explains the notations used in result tables to make their interpretation easier.

Table 9: Explanations of dissimilarity parameters

Dissimilarity parameter (DP)	Population nested	Region nested	Language nested
Nest 1	Extra large	Northern	German
Nest 2	Large	Western	Romance
Nest 3	Medium	Central	English
Nest 4	Small	Southern	Dutch
Nest 5			Nordic

Table 10 lists the results from estimating the probability that a headquarters chooses an urban area based on the variables in Equation (4.1). First of all, an important observation arises concerning the fit of different nesting models. The Table 10 excludes the results of the population nested model (they are available in Appendix 5) due to their unreliability. The dissimilarity parameters (DPs) show that, for the majority of specifications and nests, the population nested model is consistent with profit-maximization only for some explanatory variables, but not all of them.[23] Also, the insignificance of the LR test for IIA assumption in most specifications of the population nested model indicates that the null hypothesis of dissimilarity parameters being equal to one cannot be rejected. Thus, it is not sure that the population nested logit fits the data better

[23] According to Train (2002), when the dissimilarity parameter value is greater than one, a model consistently measures utility-maximizing behavior only for a range of explanatory variables.

than a standard conditional logit. Looking at the division of urban areas in Appendix 2, the inability of the population nested model to categorize urban areas in groups of substitutive urban areas is not surprising. For example, Amsterdam, London, and Luxembourg that belong to the top four urban areas gaining the most headquarters in this study are all in different population nests. This suggests that the population size is not a central consideration when firms prepare to choose their headquarters' location. These results in mind, this study focuses on analyzing the region and language nested models.

Specifications (1), (2), and (3) in Table 10 represent the region nested model while (4), (5) and (6) represent the language nested model. The average number of choices that firms have in the region and language nested models is 18.75 and 15, respectively. As for the interpretation of coefficients, studies with nested logit models use elasticities to calculate the extent to which percentage-point changes in the values of independent variables influence the probability that the average headquarters chooses a certain location. These elasticities are equal to $\beta_{\mathrm{i}}(1 - P_{\mathrm{k}})$, where β_{i} is the estimated coefficient for a variable and P_{k} is the probability of choosing an alternative in nest k approximated by the average location choice.[24]

This study conducts two estimations with slightly different datasets; one with all headquarters and the other with only intermediary headquarters in the relocations sample. The following subsections present the results of these estimations respectively while contrasting the results to previous studies and some real-life examples.

5.1. Headquarters in general

Previous theories and evidence in the economic geography literature focus on headquarters in general without distinguishing different types of them. To

[24] Post-estimation commands in Stata estimate these probabilities automatically, and they are available upon request.

compare the results of this study to the previous ones, the following subsections go through the results related to the three relevant geographical levels from estimations conducted with all headquarters in the relocations dataset. The last subsection assesses how well the nested logit model fits the data of this study.

5.1.1. Country environment

The results in Table 10 show that the corporate income tax rate negatively and significantly influences the attractiveness of an urban area for headquarters in every specification of both nested models, although the influence is smaller in the language nested model. Specification (2) indicates that a percentage-point increase in the corporate income tax rate in a certain urban area decreases the probability that a headquarters chooses that urban area by 2.08%. Similarly, specification (5) estimates a 1.93% decrease. The data collection method and especially the exclusion of pure legal domicile relocations ensures that the importance of corporate income taxes is not overemphasized. Thus, these results represent the importance of corporate income taxes in the locations choices that consider other aspects of the prospective urban areas too.

The elasticities are close to the 2.25% increase that Strauss-Kahn and Vives (2009) estimate in their study of headquarters' moves in the U.S with a population nested model. However, they are higher than those of Egger et al. (2013), who estimate a 0.9-1.3% increase in the probability with different ways of nesting countries all around the world. Other studies, such as Laamanen et al. (2012) and Voget (2011) using data in Europe and worldwide, support the negative sign of the estimate, but the magnitudes are hard to compare because they do not compute the elasticities. Based on solely corporate taxation, it is thus no wonder that, for example, Ireland has recently attracted the headquarters of many international technology firms. It taxes 12.5% of corporate incomes, which is more than 10 percentage points less than the last decade's average rate in the UK, its geographical counterpart.[25]

[25] The average corporate income tax rate in the UK between 2008 and 2019 is 22.9%.

Table 10: Main estimation results

Variable	(1)	(2)	(3)	(4)	(5)	(6)
ln_corporate income tax rate	-2.47***	-2.11***	-1.51**	-1.62***	-1.96***	-1.35**
	(0.61)	(0.46)	(0.47)	(0.40)	(0.44)	(0.42)
Large airport	2.33***	1.56***	1.45***	1.64***	1.27**	0.92*
	(0.56)	(0.41)	(0.40)	(0.48)	(0.43)	(0.37)
Medium airport	1.22**	0.83*	0.91**	0.82*	0.65	0.57*
	(0.41)	(0.33)	(0.32)	(0.35)	(0.34)	(0.26)
ln_distance	-0.57**	-0.68***	-0.75***	-0.34	-0.60***	-0.66***
	(0.22)	(0.17)	(0.16)	(0.20)	(0.17)	(0.16)
ln_HQ-specific wage	1.72**	0.66	1.07**	1.14**	0.44	0.64
	(0.61)	(0.36)	(0.39)	(0.37)	(0.33)	(0.36)
ln_population size	-0.49**	-0.70***	-0.37*	-0.33*	-0.54**	-0.19
	(0.16)	(0.17)	(0.19)	(0.13)	(0.18)	(0.16)
ln_HQs overall		-0.25	-0.21		-0.15	-0.11
		(0.15)	(0.14)		(0.15)	(0.12)
ln_HQs in the same industry		0.77***	0.67***		0.65***	0.53***
		(0.16)	(0.15)		(0.16)	(0.14)
ln_support service availability		1.49***	0.79*		1.09*	0.57
		(0.41)	(0.33)		(0.46)	(0.33)
ln_labor income tax rate			-1.42**			-1.10**
			(0.48)			(0.41)
ln_country conditions score			4.09**			4.12*
			(1.53)			(1.64)
DP						
Nest 1	0.56*	0.40**	0.25*	0.60***	0.62***	0.53***
	(0.22)	(0.15)	(0.11)	(0.13)	(0.13)	(0.16)
Nest 2	0.95***	0.87***	0.78***	0.67***	0.76***	0.68***
	(0.20)	(0.13)	(0.13)	(0.16)	(0.16)	(0.15)
Nest 3	0.83***	0.78***	0.80***	0.83***	0.75***	0.61***
	(0.18)	(0.14)	(0.17)	(0.21)	(0.16)	(0.15)
Nest 4	1.22*	0.93**	0.81**	0.56***	0.62**	0.41*
	(0.53)	(0.31)	(0.31)	(0.16)	(0.23)	(0.18)
Nest 5				0.36**	0.32*	0.22*
				(0.14)	(0.13)	(0.089)
N	12607	12607	12607	12607	12607	12607
LR		121.3***	25.9***		113.0***	25.6***
LR IIA	12.5*	11.9*	20.9***	25.2***	16.3**	25.0***

Note: Specifications (1), (2), and (3) are region nested, and (4), (5) and (6) are language nested. Standard errors in parenthesis. The symbols ***, **, * denote significance at the 1%, 5% and 10% levels, respectively. DPs refer to dissimilarity parameters. N indicates the product of the number of HQs relocating and the number of potential urban areas for each HQ.

Along with corporate income taxes, the labor income tax rate is significantly and negatively associated with the attractiveness of urban areas for headquarters

according to the results. Specifications (3) and (6) in Table 10 demonstrate that a percentage-point increase in the average labor income tax rate in an urban area decreases the probability that a headquarters chooses it by 1.40% and 1.09%, respectively. Egger et al. (2013) offer a good comparison point for the results of this study since, regardless of using headquarters relocations to 120 different countries around the world, they use the same method to define the labor income tax rate. The elasticities estimated here compare to their results in the distance nested models, where a similar change entails a 1.1% or 1.4% decrease in the probability of being chosen as a headquarters' location. In their income and region nested models, the decreases in the probability of being chosen from a one-percentage-point increase in the labor income tax rate are 3.6% and 2.2%, respectively.

The last country-level variable describing the country conditions has a positive, although less consistently significant, influence on the attractiveness of urban areas for headquarters. The dataset includes relocation cases that happened due to the UK's Brexit referendum and thus can overestimate the importance of country conditions compared to normal times. Therefore, robustness checks that run the same analysis while excluding all relocations from the UK in and after 2016 (available in Appendix 6) are in order. In the region nested model, the results for country conditions are practically the same, although slightly less significant. Meanwhile, the coefficient of the country conditions variable decreases and becomes insignificant in the language nested model. It is important to note, however, that poorer significance might simply result from the decrease in sample size caused by the exclusion of relocation cases to the UK.

According to the specification (3) in Table 10 above, a 1% decrease in the country conditions score decreases the probability that headquarters choose an urban area by 4.04%. Earlier studies offer no comparison point for this estimate since

none of them has conducted a similar analysis.[26] However, the positive influence of country conditions score is in line with previous findings that emphasize the importance of institutions for headquarters overall and in high-technology industries (Ascani, et al., 2016). As the industry composition in Table 4 demonstrates, the dataset contains a large share of relocations in technology-intensive sectors such as information and communication as well as finance and insurance.

Comparing the UK before and after the Brexit referendum offers an example to demonstrate the importance of country conditions. The country conditions score of UK decreased by 1.3% (a decrease fully caused by the lower political stability score) from 2015 before the vote to 2018 when the negotiations with the EU had been going on for a while. Thus, the results suggest that headquarters are more than 4% less likely to choose UK urban areas as their location after the Brexit vote if other factors remain constant. This idea reflects well the reality, as especially London has experienced a great outflow of headquarters after UK decided to resign from the EU.

Including the country conditions variable in the analysis decreases the coefficient of the corporate income tax variable in both nesting models. The correlation table in Appendix 7 reveals a potential explanation for this result: the corporate income tax rate and country conditions score are rather highly and negatively correlated (correlation coefficient is -0.575). In practice, a negative correlation indicates that a country with a more stable political situation and higher-quality institutions has a lower corporate income tax rate. It is, however, hard to set such a relationship in stone based on the data of this study. For example, Belgium and Germany score similarly in the country conditions (in 2019, their scores were 22.05 and 22.74, respectively) but Belgium taxed 29% of

[26] Valentino et al. (2019), as the only other ones including institutional considerations in headquarters' location decisions, find similarly that a decreasing quality of institutions increases the probability that headquarters move away. However, their logistic regression results on the probability of moving do not compare to the elasticities calculated here.

corporate profits while Germany's corporate income tax rate was only 16% in 2019. Nevertheless, one clear conclusion is that a comprehensive model of headquarters' location choice considers corporate income taxes together with other country-level characteristics.

5.1.2. Urban environment

The relationship between large airports and the attractiveness of urban areas for headquarters is significant and positive in all specifications in Table 10. In the region nested model, the estimates are consistently significant at a 1% level, while the significance varies more in the language nested model. The estimates for medium airports are at least weakly significant in most specifications. Since airport variables are in dummy format, this study calculates the influence of hosting an airport using an odds ratio. According to specification (2), the probability that a headquarters chooses a certain urban area increases by roughly 376% if it hosts a large airport and 129% if it hosts a medium airport, compared with an urban area that does not host any airports. In other words, the former estimate indicates that a headquarters is almost 4 times more likely to choose an urban area with a large airport than an urban area without one. The relatively higher importance of large airports compared to medium ones is in line with the suggestion in section 3.2.2. that medium airports might not offer good enough connections for the headquarters of especially large and geographically spread-out firms. Nevertheless, both types of airports seem beneficial since out of the 10 urban areas that gained the most headquarters in Table 3, five hosts a large airport, and the other five a medium one.[27]

The importance of airports of both sizes is greater in the results of this study compared to those of Strauss-Kahn and Vives (2009), who conduct the only other

[27] Urban areas hosting a large airport are Amsterdam, London (City, Camden and Westminster), Frankfurt and Madrid. Dublin, Luxembourg, Vienna, Brussels and Berlin host a medium airport.

study with airport facilities included in headquarters' location choices.[28] In their similar analysis, having a large airport increases the probability of being chosen by 90% and having a small airport (comparable to a medium airport in this study) by 40%. While the different geographical contexts can explain this large difference, it is more likely caused by the fact that the data of this study contains only cross-border relocations later in the 21st century. While relocating headquarters across country borders supports the international nature of firms, it also explicitly increases the importance of connections if some activities of the same firm remain in the original country. Furthermore, firms' operations have undergone an exponential internationalization after 2001 that is the latest data point of Strauss-Kahn and Vives (2009). Consequently, being well-connected to all parts of the world through international flight connections has become increasingly crucial. This is true, especially for headquarters whose tasks require interactions with other geographically spread out parts of the firm.

The distance to other units of the same firm reflects the costs of delivering headquarters' tasks and has a consistently significant negative influence on the attractiveness of an urban area for headquarters (except in specification (4)). Based on specifications (2) and (5), being 10% further away from the headquarters' original position, that proxies the distance to other units, decreases the probability that a headquarters chooses an urban area by 5.89% and 5.20%, respectively. While many earlier studies (e.g. Henderson and Ono (2008) and Belderbos et al. (2017)) support the negative sign of the influence, Strauss-Kahn and Vives (2009) offer the only comparison point for its magnitude.[29] The results here differ from theirs in two ways: this study finds a significant influence also in the region nested model and the decrease in probability is more than twice as high in both specifications of this study. Even the influence of distance they estimate for manufacturing headquarters' location

[28] Bel and Fadega (2008) focus on airport facilities too, but their study deals with headquarters agglomeration rather than location choices.
[29] As a reminder, this study uses the same method for collecting the distance data as Strauss-Kahn and Vives (2009).

choices remains lower than the one estimated in this study. This difference is interesting since previous studies suggest that manufacturing firms would place higher importance on the proximity of headquarters and other units compared to firms in other industries.

A likely explanation for these differences is the fact that Strauss-Kahn and Vives (2009) use U.S. regions covering a smaller land area than the European regions in this study consisting of multiple countries. Larger distances between urban areas in the same European region than in the same U.S. region lead to more variance in costs of delivering headquarters' tasks. Also, these costs seem to play a more important role for firms that choose to locate their headquarters in Europe. One possible explanation for the higher importance is that the operations of such firms are more spread out geographically.

The headquarters-specific wage is positively associated with the attractiveness of urban areas for headquarters as expected in section 3.2.2. The positive association stems from the high skills of employees that are vital in headquarters' operations. The wage coefficients are significant in specifications (1) and (4) when the agglomeration economies are not measured, which suggests that headquarters-specific wages capture some of the positive influence of other headquarters and support services in these specifications. This is logical as higher wages coexist with skilled employees that headquarters and support services need. Nevertheless, this positive wage coefficient turns insignificant when agglomeration economies are introduced. It thus seems that headquarters prioritize other elements such as agglomeration economies before wages and give more weight on having highly skilled employees than on the increased costs that these employees bring about. In other words, the skilled employees and agglomeration economies entail enough efficiency gains that the profitability of firms increases regardless of the increased wage costs. The results thus seem to support the initial idea of Egger et al. (2013), who suggest that the importance of wages decreases when high-skilled labor is available.

As the last variable describing the urban environment, the population size has a persistently negative and mainly significant influence on the attractiveness of urban areas for headquarters across different specifications. Earlier studies argue that the population size negatively influences the location choices of headquarters due to the congestion costs it entails. However, previous empirical evidence offers weak support for this idea. For example, the results of Strauss-Kahn and Vives (2009) argue that the population size could have either a negative or a positive influence. Previous evidence also lacks consistent evidence for the simultaneous estimation of population and agglomeration economies. For example, Belderbos et al. (2017) find a consistent and significant negative influence but ignore the agglomeration economies.[30]

The results suggest that a larger population does increase congestion costs even in the presence of agglomeration economies. Relying on the specifications (2) and (5), a 10% increase in urban area population decreases the probability that a headquarters relocates there by 6.90% and 5.32%, respectively. Henderson and Ono (2008) support the negative influence of population size on the attractiveness of urban areas for headquarters, although their results are not directly comparable to those of this study due to our different research settings. The negative influence of population size potentially contributes to the fact that out of the five urban areas that have gained the most headquarters in the relocations sample (see Table 3), three have less than three million inhabitants on average during the time period of this study. The example of London demonstrates, however, that headquarters sometimes neglect the detrimental influence of a large population. Although the average population of the metropolitan London between 2009 and 2019 is 8.4 million, it has still gained the third most headquarters (20 in total) in the relocations sample.

[30] As explained in the literature review, measuring the population simultaneously with agglomeration economies is important because the population size could otherwise capture the availability of support services or high-skilled labor.

Excluding locations-specific fixed effects implies that this study has to consider separately whether there exist some location-specific attributes whose influence on the location choices and the presence of headquarters and services persists over time (see section 4.2.3.). One such attribute is the level of amenities (recreational activities, museums, health services etc.) in an urban area. The level of amenities makes an urban area more enjoyable for the headquarters' employees but is simultaneously likely to correlate highly with its population size and availability of airports (for example, tourism needs both airports and amenities). Due to the lack of appropriate data on amenities, this study cannot leverage on robustness tests to see if the estimates for the population size and airport availability are too high because they capture some of the influence that amenities would if included. Strauss-Kahn and Vives (2009), who run such robustness checks, find that the introduction of amenities slightly decreases the positive influence that airports have on the location choices of headquarters and makes the availability of medium airports insignificant in the region nested model. Based on their results, the estimate that this study finds for airports might be slightly overemphasized compared to their importance in reality.

5.1.3. Agglomeration economies

The literature review demonstrates that studies dating even a long time back see agglomeration economies as a central element in headquarters' location choices. Among previous studies on the role of agglomeration economies in the location choices, David and Henderson (2008) emphasize the importance of the same industry headquarters. Strauss-Kahn and Vives (2009) measure overall and same industry agglomeration and find significant influences for both, the latter being more important than the former. Meanwhile, they also discover that the share of employment in the same industry has an even larger positive influence.

The estimation results of this study shed new light on the importance of agglomeration economies in headquarters' location choices. Contrasting the results to the existing pool of evidence, it seems that the agglomeration of other

headquarters in the same industry is the crucial element in headquarters' location choices. An important remark at this point is, however, that the agglomeration variable can embody other crucial elements connected to the presence of headquarters in the same industry such as overall specialization that an urban area has developed in the industry. Although the agglomeration variable might not indicate the importance of being close to the headquarters in the same industry solely, it offers a useful measure for understanding the importance of inputs that any operations in the same industry offer for headquarters. These inputs are equivalent to the crucial knowledge that other headquarters in the same industry would transmit. These seem indeed important for headquarters since a 10% increase in the number of same industry headquarters hosted in an urban area increases the probability that a headquarters chooses to locate there by 7.60% and 6.41% according to specifications (2) and (5) in Table 10. The positive influence remains highly significant in all specifications. The results of Strauss-Kahn and Vives (2009) support those in this study, as they find out that the equivalent estimate is 6.7%.

The case of Luxembourg offers an example to demonstrate the power of the same industry agglomeration. From 2013 to 2016, Luxembourg saw its number of headquarters in the finance and insurance sector triple (an increase of 300%) from 10 to 30 based on the headquarters data. This increase corresponds to a 228% increase in the probability of being chosen by a headquarters in the finance and insurance sector. In other words, these headquarters are more than twice as likely to choose Luxembourg in 2016 than in 2013 if other factors remained unchanged. After 2016, Luxembourg indeed gained more headquarters in this sector than any urban area during the 11 years examined in the relocation sample (most of them came from London).

Meanwhile, the negative although insignificant sign of the coefficient in Table 10 suggests that agglomeration of headquarters overall reduces the attractiveness of urban areas for headquarters. This contradicts the expectations formed in section 3.2.2. based on Table 5 where chosen urban areas

have on average more headquarters overall in all sectors than all potential urban areas. Henderson and Ono (2008), whose results also indicate that headquarters agglomeration negatively influences first-ever location choices, suggest that competition threats drive headquarters away from these concentrations at the first establishment. Such an influence is unlikely to prevail in this study since the dataset includes relocations of headquarters, which means the firms included have already established their position in the market. This study interprets the negative influence as a similar congestion effect that population size has, while not concluding anything definite based on the insignificant coefficients. In practice, it is logical that headquarters in the same industry benefit from the proximity of each other through knowledge exchanges, while headquarters in irrelevant industries cannot offer useful knowledge and are therefore seen as detrimental.

The other central agglomeration economies arising from the availability of support services prove important also in this study. Their influence on the location choices of headquarters is positive and mainly significant. Based on the specifications (2) and (5) in Table 10, an increase of 10% in the support service availability in an urban area increases the probability of being chosen by a headquarters by 14.70% and 10.75%, respectively. As a real-life example, the average support service availability index is 15% higher in Amsterdam, where the most headquarters (21 in total) have relocated to in the relocations sample than in the area around Rotterdam (Great Rijnmond) that has gained one headquarters. Headquarters are thus around 22% or 16% more likely to choose Amsterdam over Rotterdam based on their support service availability only. The results are in line with Strauss-Kahn and Vives (2009), who find that the probability increase induced by a 10% increase in support service availability is between 7% and 13.5%.[31] While other previous studies (e.g. Davis and Henderson (2008) and Bel and Fadega (2008)) cannot offer a comparison point

[31] This study uses the same way to measure the service specialization as Strauss-Kahn and Vives (2009) but, contrary to them, counts both business and financial service specialization together.

for the magnitudes, they consistently support the positive influence of support services on the locations choices of headquarters.

Although educated labor pools are not included in the main analysis, their importance relative to the other two agglomeration economies that Marshall (1920) originally introduce requires testing. The results for these robustness checks (presented in Appendix 8) are similar to those of Strauss-Kahn and Vives (2009), who conduct the same test. The introduction of a labor pool variable makes the coefficient of support services variable insignificant in both region and language nested models of this study. Meanwhile, the coefficient of the labor variable itself is not statistically significant. The correlation table in Appendix 7 supports these observations as the correlation between these two variables is as high as 0.735. In line with the suggestion made by Strauss-Kahn and Vives (2009), the educated labor pools seem to reflect the availability of headquarters and support services employing the labor force instead of having an important influence on headquarters' location choices on their own.

Tax incentives are another factor that this study excludes from the analyses but that without a doubt influence both headquarters' location choices and the presence of headquarters and support services in an urban area. The influence of tax incentives could be controlled for with location-specific fixed effects. As section 4.2.3. explains, such controls are inconvenient in the current research context. Thus, this study settles for acknowledging that the agglomeration economies from other headquarters and support services might influence the location choices of headquarters a little less in reality than the results here suggest.

Tax incentives are, however, only one example of potentially relevant locational characteristics that the analysis of this study omits. The country conditions score can potentially capture omitted characteristics more broadly at the country level. Consequently, introducing the country conditions score to the analysis could alleviate the potentially overemphasized influences of

agglomeration economies since headquarters and support services require good conditions to operate. This happens if some country conditions influencing the choice of an urban area by a headquarters also influence the presence of other headquarters and support services there previously. As specifications (3) and (6) show, the coefficient measuring the importance of support service availability almost halves, and its significance decreases when country conditions enter the estimation. The coefficients of both headquarters agglomeration variables also decrease slightly. The presence of support services and other headquarters thus seems to capture some of the positive influence of good country conditions in other specifications. This insight is pioneering since previous studies measuring the importance of these agglomeration economies on headquarters' location choices have not considered country conditions. As a result, the role of agglomeration economies in headquarters' location choices might not be as central as previously suggested.

5.1.4. The goodness of fit of models

Likelihood-ratio tests conducted between each specification show that adding more variables always increases the model's fit to the current data. Such results suggest that it is important for headquarters to consider their locations at multiple geographical levels from the proximate neighborhood to the country context. The likelihood-ratio test for IIA serves to decide whether the zero hypothesis that a standard conditional logit model with complete independence from irrelevant attributes would fit the data of this study better can be rejected. In other words, this compares to testing whether a model with all dissimilarity variables equal to 1 would fit the data better. The test results reject the null hypothesis and thus confirm that both region and language nested logit fit the data significantly better than the standard conditional logit. Overall, this conclusion is more solid in the language nested model, since the IIA test result is significant only at a 10% level in specifications (1) and (2) of the region nested model but at 1% or 5% level in the language nested model.

The values of dissimilarity parameters between 0 and 1 in Table 10 (except in the southern European nest in the specification (1)) confirm that the model is consistent with profit-maximizing behavior for all possible values of the explanatory variables. Furthermore, the values and significance of these parameters offer insights into the substitutability of urban areas in different nests and thereby the relevance of the nested structure. In general, the closer the dissimilarity parameter is to 0 the higher the correlation is between the unobserved components with the nest. In other words, the closer substitutes the urban areas of the nest are to each other in the eyes of the headquarters choosing between them. Since substitutability is a crucial requirement of the nested logit model, closer substitutability makes the nested structure more relevant.

To my knowledge, this study is the first one among those studying headquarters' location choices with nested logit to allow for differences in the dissimilarity parameters across nests. These differences reveal a more detailed picture of the substitutability of urban areas in different nests and, thus, the relevance of a nested structure build based on these nests. Although this study does not conduct specific tests to confirm the statistical significance of the differences, comparing the dissimilarity parameter values in Table 10 offers insights into which urban areas are possibly closer substitutes to each other. The most remarkable observation are the smaller parameter values for urban areas in Northern Europe and speaking Nordic languages. This suggests that they are possibly better substitutes for each other than urban areas in other regions or speaking other similar languages. Such an observation is not surprising since the Nordic countries differ from the rest of Europe based on both geographic and language distance.

5.2. Intermediary headquarters

Economic geography studies on headquarters' location choices traditionally treat all headquarters as homogeneous. However, similar studies in the international business literature offer valuable insights into how location

choices differ among different types of headquarters by focusing solely on regional headquarters (e.g. Laamanen et al. (2012) and Belderbos et al. (2017)). While economic geography studies emphasize the importance of traditional factors like corporate taxation and agglomeration economies, studies in international business literature discover that some of the traditional factors matter less in the location choices of regional headquarters. Their choices rather follow their connectivity needs (Belderbos et al., 2017). Since regional headquarters also tend to be more prone to relocations than corporate headquarters (Laamanen et al., 2012), understanding their and other intermediary headquarters' location choices is relevant for economic geography literature. This section aims to expand the evidence on the locational choices made by intermediary headquarters and the possible differences from those made by corporate ones.

This section conducts an analysis with the intermediary headquarters in the relocations sample that includes both regional and divisional headquarters. Although earlier studies focus on regional headquarters, divisional ones are also a crucial part of any international firms' operations. Both of them act as links between the corporate headquarters and geographically spread out subunits.

Table 11 shows the results of estimations with only intermediary headquarters in the relocations sample. As the mainly insignificant results for IIA tests show, the results are less reliable than in the main estimation. The weak significance could be solely the cause of a much smaller sample size, when it would say nothing about the importance of locational characteristics on intermediary headquarters' location choices. In any case, the results offer initial insights calling for further evaluation with larger samples in future studies.

The results in Table 11 suggest that intermediary headquarters attach slightly lower importance to the tax levels in their country environment than corporate ones. Previous studies focusing on intermediary headquarters support these results (e.g. Laamanen et al., 2012 and Belderbos et al., 2017). While the probability that all headquarters choose an urban area decreases by around 2%

after a one-percentage-point increase in the corporate income tax rate, the probability that an intermediary headquarters chooses it decreases by 1.63%.

Table 11: Estimation with intermediary headquarters

Variable	(1)	(2)	(3)	(4)	(5)	(6)
ln_corporate income tax rate	-1.27***	-1.65***	-0.87	-0.55	-1.66**	-1.36*
	(0.38)	(0.50)	(0.51)	(0.36)	(0.56)	(0.63)
Large airport	2.20**	1.86**	1.41*	0.93	1.73*	1.50
	(0.72)	(0.62)	(0.57)	(0.64)	(0.74)	(0.79)
Medium airport	1.33*	1.07*	0.96*	0.50	0.97	0.90
	(0.56)	(0.52)	(0.46)	(0.39)	(0.59)	(0.58)
ln_distance	-0.53*	-0.76***	-0.75***	-0.14	-0.67**	-0.80***
	(0.21)	(0.20)	(0.19)	(0.12)	(0.22)	(0.24)
ln_HQ-specific wage	0.67	0.28	0.41	0.082	0.036	-0.037
	(0.35)	(0.36)	(0.37)	(0.15)	(0.41)	(0.50)
ln_population size	-0.34**	-0.63***	-0.22	-0.16	-0.59**	-0.38
	(0.13)	(0.19)	(0.20)	(0.12)	(0.23)	(0.26)
ln_HQs overall		-0.051	-0.076		0.12	0.17
		(0.18)	(0.16)		(0.19)	(0.20)
ln_HQs in the same industry		0.64***	0.50**		0.56**	0.52*
		(0.17)	(0.16)		(0.21)	(0.22)
ln_support service availability		0.68	0.45		0.47	0.40
		(0.36)	(0.30)		(0.44)	(0.44)
ln_labor income tax rate			-0.28			-0.50
			(0.40)			(0.59)
ln_country conditions score			4.07**			3.83
			(1.40)			(2.20)
DPs						
Nest 1	0.36*	0.22	0.15	0.33	0.65***	0.66*
	(0.16)	(0.12)	(0.11)	(0.17)	(0.19)	(0.29)
Nest 2	0.56***	0.64***	0.53***	0.16	0.61***	0.67**
	(0.14)	(0.13)	(0.14)	(0.13)	(0.18)	(0.22)
Nest 3	0.62***	0.69***	0.57**	0.16	0.63***	0.62**
	(0.16)	(0.16)	(0.19)	(0.15)	(0.19)	(0.21)
Nest 4	0.46	0.67**	0.55	0.28	0.54*	0.47
	(0.34)	(0.25)	(0.29)	(0.18)	(0.25)	(0.26)
Nest 5				0.14	0.26	0.31*
				(0.097)	(0.15)	(0.16)
N	7278	7278	7278	7278	7278	7278
LR		78.9***	10.5**		78.5***	7.13*
LR IIA	9.39	9.37	15.1**	8.25	7.85	10.2

Note: Specifications (1), (2), and (3) are region nested, and (4), (5) and (6) are language nested. Standard errors in parenthesis. The symbols ***, **, * denote significance at the 1%, 5% and 10% levels, respectively. DPs refer to dissimilarity parameters. N indicates the product of the number of HQs relocating and the number of potential urban areas for each HQ.

The difference in estimates is far more apparent when it comes to labor taxation. The coefficient estimated with intermediary headquarters is not only much lower than the one estimated with all headquarters but also consistently insignificant. Labor taxation thus seems to matter less in the location choices of intermediary headquarters. Based on earlier theories, lower importance of labor taxation indicates that either the employees in intermediary headquarters are less mobile across country borders or their effort levels are less influenced by labor income taxes. Both options suggest that employees in intermediary headquarters are less skilled than those in corporate ones. Since there is no reason to believe that this is true, I invite more research to focus on labor taxation to better understand its role in intermediary headquarters' location choices.

Finally, it is interesting to observe that the country conditions seem equally important for intermediary headquarters as for headquarters in general. This highlights the fact that all sophisticated functions need good country conditions around them.

Intermediary headquarters seem to have distinct preferences over their urban environment as well. While minimizing the distance to other units of the same firm is slightly more important for intermediary headquarters that for all headquarters, the difference in the importance of good airline connections even more apparent. The calculations for all headquarters in the previous section show that hosting large and medium airports increase an urban area's probability of being chosen by 376% and 129%, respectively. Calculating the odds ratios based on the results in Table 11, the corresponding increases in the probability of gaining intermediary headquarters are 542% and 192%. Meanwhile, the influence of wages is insignificant and population size has only a slightly milder negative influence on the attractiveness of urban areas for intermediary headquarters compared with all headquarters. The need for good airline connections to execute the headquarters' tasks thus seems to be the

crucial aspect setting intermediary headquarters apart from corporate headquarters that form the other type of headquarters in this study.

These results support the conclusions of Belderbos et al. (2017) about the importance of connectivity needs for regional headquarters. It is presumably safe to generalize these conclusions to all intermediary headquarters. They act as mediators between the corporate headquarters and the spread-out subunits of the same firm transmitting information from one to the others. Thus, the need for good airline connections to reach multiple corners of the world drives intermediary headquarters to opt for urban areas that host especially large airports.

The importance of agglomeration economies also distinguishes intermediate headquarters from corporate ones. Agglomeration of same industry headquarters seems to retain its importance among intermediary headquarters, but the influence of support service availability in their location choices is both lower than in the estimation with all headquarters and insignificant. Thus, it seems that corporate headquarters are more dependent on these agglomeration economies than intermediary headquarters. This idea enforces the allocation of roles that assigns intermediary headquarters as the ones keeping up connections between subunits and corporate headquarters, and corporate headquarters as the center that collects crucial information and ensures access to support services for the whole firm.

All in all, these results strongly support the previous insights by especially Belderbos et al. (2017) on the importance of connectivity for intermediary headquarters. What comes to other locational characteristic, the results of this study give a good start for further discussion, but the literature requires more in-depth studies with larger samples to establish clearer ideas about how different characteristics influence the attractiveness of locations in the eyes of intermediary headquarters.

6. Discussion & implications

To sum up, the results suggest that headquarters of international firms are prone to choose urban areas that are close to other units of the same firm and that have low taxes especially on corporate income but also on labor income, good country conditions, large airports, small population, agglomerations of headquarters and other activities in their industry sector and good availability of support services. Aligned with previous theories and evidence, airports with good connections are especially important for intermediary headquarters due to their roles as mediators between the corporate headquarters and subunits of their firm. Furthermore, this study supports the evidence that educated labor pools influence location choices indirectly as other headquarters and support services, whose presence directly influences the location choices, employ such high-skilled labor. The significant results concerning locational characteristics at the level of agglomerations, urban areas, and countries show that broadening the research perspective to cover all three geographical levels deepens the understanding of headquarters' location choices.

A crucial difference between this study and the previous ones in the economic geography literature arises with regard to wages. Contrary to many previous studies, the results of this study suggest that wages are not a central consideration in headquarters' location choices and that their influence is positive when it exists. This contradiction arises because this study measures headquarters-specific wages that are more relevant for headquarters than the general level of wages and relate to the high skill level of headquarters' employees. It seems that skilled employees and other factors such as agglomeration economies entail enough efficiency gains in headquarters to maintain the firm's profitability regardless of the increased wage costs. I suggest that economic geography literature would benefit from integrating the trade-off between wages and the skill level of employees more deeply in the theories. Consequently, the literature could gain new perspectives through no longer seeing wages as a detrimental implication of congestion but rather a positive indication of the high skills available.

The results for corporate income taxes, airports and distance as well as agglomeration economies are also unique in terms of magnitudes of the estimates. Including a broader country-level context into headquarters' location choices shows that the importance of corporate income taxes alone might be exaggerated in previous studies. Indeed, headquarters take into account labor taxation, quality of institutions, and political stability as well. The latter two characteristics become increasingly important when sectors with technology-intensive operations dominate the economy. Additionally, time will show how the ongoing negotiations over international taxation rules of multinational companies (the Base Erosion and Profit Shifting (BEPS) initiative led by the OECD and G20 countries) change the role of corporate taxation in headquarters' location choices.

Furthermore, the results indicate that airports and minimized distance to other units of the same firm are much more important in headquarters' location choices than what previous studies conclude. The reason for this observation is likely to lie in the dataset; the focus on contemporary firms with international operations and their cross-border relocations in a multi-country context in Europe highlights the importance of connections and minimizing the distance to other units. While previous studies suggest that the industry of a firm shapes its preferences over especially proximity, this study argues that the geographic context and the international ambitions of firms under study matter more. It will be interesting to see, however, how the importance of airline connections evolves as sustainability considerations are more and more involved in daily operations and digital connectivity makes headway with more advanced technologies. A study using data from the next decades might well find very different results concerning airports and distance.

Lastly, the introduction of country conditions in the analysis decreases the importance of agglomeration economies perhaps because the presence of other headquarters and support services reflects good country conditions. Thus, it seems appropriate to consider the importance of agglomeration economies in

headquarters' location choices emphasized by previous studies with precaution. This, again, highlights the relevance of considering the three geographical levels to comprehensively understand the interplay of different locational characteristics in the location choices of headquarters.

The results are of interest to urban areas and countries looking for ways of attracting headquarters of international firms. In addition to focusing on traditional means such as optimizing corporate taxation, it is appropriate for them to, for example, build up the capacity of airports and attract support service providers. Countries could benefit from developing several smaller (in terms of urban area population) but competitive business centers in their regions instead of one giant one. Studies like this one concentrating on the location choices of headquarters can, however, offer limited insights into the monetary efforts that are well-founded for policy actions and regional development to attract headquarters. For example, defining the monetary incentives for attracting support service providers and headquarters requires a more detailed quantification of the magnitude of agglomeration economies.

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Appendices

Appendix 1: Data sources and descriptions

Characteristic	Data source	Description
HQs overall & HQs in the same NACE industry	Orbis	Headquarters defined as units with at least one branch attached to them
Support service availability	Eurostat, Employment by age, economic activity and NUTS 2 regions (NACE Rev. 2)	Persons aged 25 to 64 years, NACE sectors J, K and M-N
Educated labor pool	OECD Regional Education, Share of population 25 to 64 year-olds by educational attainment	Education ISCED level 5 to 8 = tertiary education
HQ-specific hourly wage (except FR and NL)	Eurostat, Compensation of employees/Employment (thousand hours worked) by NUTS 2 regions	NACE sector M-N (professional, scientific and technical activities as well as administrative and support service activities)
HQ-specific hourly wage (FR)	Eurostat, Compensation of employees/Employment (thousand hours worked) by NUTS 2 regions & Insee, Monthly base wage index - Scientific and technical activities, Administrative and support service activities	Eurostat value from 2015 scaled based on the wage index
HQ-specific hourly wage (NL)	Eurostat, Compensation of employees/Employment (thousand hours worked) by NUTS 2 regions & StatLine, Labour price index - Other specialised business services	Eurostat value from 2015 scaled based on the labor price index
Population size	Eurostat, Population on 1 January by NUTS 2 region	
Airports	Eurostat, Air transport of passengers by NUTS 2 regions	Large airports transport more than 1%, medium ones 0.05-1% and small ones less than 0.05% of total yearly passengers in Europe.
Distance	DistanceFromTo (distancefromto.net)	Straight-line distance between cities
Corporate income tax rate	OECD, Statutory corporate income tax rate	
Labor income tax rate	OECD, Average personal income tax and social security contribution rates on gross labour income	All-in rate (Employee SSC and Combined central and sub-central government taxes) for the average wage

Appendix 1: Data sources and descriptions (continued)

Characteristic	Data source	Description
Country conditions score	Political Risk Services (PRS), International Country Risk Guide	Scores included: Political stability, Corruption, Bureaucracy quality, and Law & order

Appendix 2: List of potential urban areas by population nests

Urban area, country	Urban area, country	Urban area, country
Nest: Extra large (> 3M)	Murcia, ES	*Nest: Medium (1-0,5M)*
Berlin, DE	Sevilla, ES	Linz-Wels, AT
Barcelona, ES	Valencia, ES	Ghent, BE
Madrid, ES	Vizcaya, ES	Halle-Vilvoorde, BE
Hauts-de-Seine, FR[1]	Helsinki-Uusimaa, FI	Frankfurt am Main, DE
Paris, FR[1]	Bas-Rhin, FR	Düsseldorf, DE
Seine-Saint-Denis, FR[1]	Bouches-du-Rhône, FR	South Jutland, DK
Val-de-Marne, FR[1]	Essonne, FR[1]	East Jutland, DK
Milan, IT	Gironde, FR	Athens, ET
Camden & City of	Haute-Garonne, FR	Guipuzcoa, ES
London, UK[2]	Ille-et-Vilaine, FR	Navarra, ES
Haringey & Islington, UK[2]	Isère, FR	Zaragoza, ES
Harrow & Hillingdon, UK[2]	Loire-Atlantique, FR	Maine-et-Loire, FR
Hounslow & Richmond	Nord, FR	Luxembourg, LU
upon Thames, UK[2]	Pas-de-Calais, FR	Leeds, UK
Kensington & Chelsea	Rhône, FR	Leicestershire &
and Hammersmith &	Seine-et-Marne, FR[1]	Rutland, UK
Fulham, UK[2]	Seine-Maritime, FR	Staffordshire CC, UK
Tower Hamlets, UK[2]	Val-d'Oise, FR[1]	Cambridgeshire, UK
Westminster, UK[2]	Yvelines, FR[1]	Berkshire, UK
	Dublin, IE	Oxfordshire, UK
Nest: Large (3-1M)	Great Amsterdam, NL	West Surrey, UK
Vienna, AT	Great Rijnmond, NL	
Antwerp, BE	Utrecht, NL	*Nest: Small (< 0,5M)*
Brussels, BE	Porto Metropolitan	Wiener Umland/
Hamburg, DE	Area, PT	Südteil, AT
Hannover, DE	Lisbon Metropolitan	Mechelen, BE
Köln, DE	Area, PT	Turnhout, BE
Munich, DE	Skåne, SE	Hasselt, BE
Munich District, DE	Stockholm, SE	Kortrijk, BE
City of Copenhagen, DK	Västra Götaland, SE	Greater Manchester
Metropolitan	Birmingham, UK	South West, UK
Copenhagen, DK	Hertfordshire, UK	North Hampshire, UK

Appendix 3: List of potential urban areas by region nests

Urban area, country	Urban area, country	Urban area, country
Nest: Northern Europe	Seine-et-Marne, FR[1]	*Nest: Central Europe*
East Jutland, DK	Seine-Maritime, FR	Linz-Wels, AT
City of Copenhagen, DK	Seine-Saint-Denis, FR[1]	Vienna, AT
Metropolitan	Val-de-Marne, FR[1]	Wiener Umland
Copenhagen, DK	Val-d'Oise, FR[1]	/Südteil, AT
South Jutland, DK	Yvelines, FR[1]	Berlin, DE
Helsinki-Uusimaa, FI	Dublin, IE	Düsseldorf, DE
Skåne, SE	Great Amsterdam, NL	Frankfurt am Main, DE
Stockholm, SE	Great Rijnmond, NL	Hamburg, DE
Västra Götaland, SE	Utrecht, NL	Hannover, DE
	Berkshire, UK	Köln, DE
Nest: Western Europe	Birmingham, UK	Munich, DE
Antwerp, BE	Cambridgeshire, UK	Munich District, DE
Brussels, BE	Camden & City of	Luxembourg, LU
Ghent, BE	London, UK2	
Halle-Vilvoorde, BE	Greater Manchester	*Nest: Southern Europe*
Hasselt, BE	South West, UK	Athens, ET
Kortrijk, BE	Haringey & Islington, UK[2]	Barcelona, ES
Mechelen, BE	Harrow & Hillington, UK[2]	Guipuzcoa, ES
Turnhout, BE	Hertfordshire, UK	Madrid, ES
Bas-Rhin, FR	Hounslow & Richmond	Murcia, ES
Bouches-du-Rhône, FR	upon Thames, UK[2]	Navarra, ES
Essonne, FR[1]	Kensington & Chelsea	Sevilla, ES
Gironde, FR	and Hammersmith &	Valencia, ES
Haute-Garonne, FR	Fulham, UK[2]	Vizcaya, ES
Hauts-de-Seine, FR[1]	Leeds, UK	Zaragoza, ES
Ille-et-Vilaine, FR	Leicestershire &	Milan, IT
Isère, FR	Rutland, UK	Porto Metropolitan
Loire-Atlantique, FR	North Hampshire, UK	Area, PT
Maine-et-Loire, FR	Oxfordshire, UK	Lisbon Metropolitan
Nord, FR	Staffordshire CC, UK	Area, PT
Paris, FR[1]	Tower Hamlets, UK[2]	
Pas-de-Calais, FR	Westminster, UK[2]	
Rhône, FR	West Surrey, UK	

Appendix 4: List of potential urban areas by language nests

Urban area, country	Urban area, country	Urban area, country
Nest: German speaking	Maine-et-Loire, FR	Leeds, UK
Linz-Wels, AT	Nord, FR	Leicestershire &
Vienna, AT	Paris, FR[1]	Rutland, UK
Wiener Umland	Pas-de-Calais, FR	North Hampshire, UK
/Südteil, AT	Rhône, FR	Oxfordshire, UK
Berlin, DE	Seine-et-Marne, FR[1]	Staffordshire CC, UK
Düsseldorf, DE	Seine-Maritime, FR	Tower Hamlets, UK[2]
Frankfurt am Main, DE	Seine-Saint-Denis, FR[1]	Westminster, UK[2]
Hamburg, DE	Val-de-Marne, FR[1]	West Surrey, UK
Hannover, DE	Val-d'Oise, FR[1]	
Köln, DE	Yvelines, FR[1]	*Nest: Dutch speaking*
Munich, DE	Milan, IT	Antwerp, BE
Munich District, DE	Luxembourg, LU	Ghent, BE
	Porto Metropolitan	Halle-Vilvoorde, BE
Nest: Romance speaking	Area, PT	Hasselt, BE
Brussels, BE	Lisbon Metropolitan	Kortrijk, BE
Athens, ET	Area, PT	Mechelen, BE
Barcelona, ES		Turnhout, BE
Guipuzcoa, ES	*Nest: English speaking*	Great Amsterdam, NL
Madrid, ES	Dublin, IE	Great Rijnmond, NL
Murcia, ES	Berkshire, UK	Utrecht, NL
Navarra, ES	Birmingham, UK	
Sevilla, ES	Cambridgeshire, UK	*Nest: Nordic speaking*
Valencia, ES	Camden & City of	East Jutland, DK
Vizcaya, ES	London, UK2	City of Copenhagen, DK
Zaragoza, ES	Greater Manchester	Metropolitan
Bas-Rhin, FR	South West, UK	Copenhagen, DK
Bouches-du-Rhône, FR	Haringey & Islington, UK[2]	South Jutland, DK
Essonne, FR[1]	Harrow & Hillington, UK[2]	Helsinki-Uusimaa, FI
Gironde, FR	Hertfordshire, UK	Skåne, SE
Haute-Garonne, FR	Hounslow & Richmond	Stockholm, SE
Hauts-de-Seine, FR[1]	upon Thames, UK[2]	Västra Götaland, SE
Ille-et-Vilaine, FR	Kensington & Chelsea	
Isère, FR	and Hammersmith &	
Loire-Atlantique, FR	Fulham, UK[2]	

Appendix 5: Main estimation results, population nested model

Variable	(1)	(2)	(3)
ln_corporate income tax rate	-4.52***	-2.80***	-2.49**
	(1.10)	(0.71)	(0.84)
Large airport	3.05***	1.96**	1.90**
	(0.87)	(0.63)	(0.66)
Medium airport	1.22*	0.84	0.96*
	(0.62)	(0.48)	(0.47)
ln_distance	-1.30**	-0.93***	-0.91***
	(0.41)	(0.26)	(0.26)
ln_HQ-specific wage	2.45**	0.54	0.80
	(0.93)	(0.49)	(0.53)
ln_population size	-1.53***	-1.07***	-0.80*
	(0.41)	(0.27)	(0.35)
ln_HQs overall		-0.40*	-0.25
		(0.20)	(0.18)
ln_HQs in the same industry		1.01***	0.84***
		(0.22)	(0.21)
ln_support service availability		1.95***	1.22*
		(0.54)	(0.50)
ln_labor income tax rate			-1.59*
			(0.64)
ln_country conditions score			2.35
			(2.14)
DPs			
Nest 1	2.54***	1.33***	1.12***
	(0.61)	(0.30)	(0.28)
Nest 2	1.53***	1.13***	1.00***
	(0.33)	(0.21)	(0.22)
Nest 3	1.32**	1.00***	0.89***
	(0.42)	(0.27)	(0.27)
Nest 4	1.92*	1.28	1.04
	(0.87)	(0.70)	(0.85)
N	12607	12607	12607
LR		80.2***	14.7***
LR IIA	46.7***	4.95	2.70

Note: Standard errors in parenthesis. The symbols ***, **, * denote significance at the 1%, 5% and 10% levels, respectively. DPs refer to dissimilarity parameters. N indicates the product of the number of HQs relocating and the number of potential urban areas for each HQ.

Appendix 6: Estimations without relocation cases from UK in or after 2016

Variable	(1)	(2)
ln_corporate income tax rate	-1.41**	-1.41**
	(0.53)	(0.46)
Large airport	1.16**	0.69
	(0.40)	(0.36)
Medium airport	0.85**	0.56*
	(0.32)	(0.28)
ln_distance	-0.72***	-0.61***
	(0.17)	(0.17)
ln_HQ-specific wage	1.19**	0.70
	(0.43)	(0.38)
ln_population size	-0.28	-0.15
	(0.19)	(0.17)
ln_HQs overall	-0.20	-0.13
	(0.14)	(0.12)
ln_HQs in the same industry	0.60***	0.48***
	(0.16)	(0.14)
ln_support service availability	0.80*	0.68
	(0.34)	(0.36)
ln_labor income tax rate	-1.53**	-1.49**
	(0.52)	(0.48)
ln_country conditions score	4.19*	3.01
	(1.72)	(1.78)
DPs		
Nest 1	0.24*	0.53***
	(0.11)	(0.16)
Nest 2	0.74***	0.63***
	(0.15)	(0.16)
Nest 3	0.72***	0.52***
	(0.19)	(0.13)
Nest 4	0.80*	0.45
	(0.39)	(0.24)
Nest 5		0.25*
		(0.10)
N	10072	10072
LR IIA	18.5**	22.3***

Note: Specifications (1) is region nested and (2) is language nested. Standard errors in parenthesis. The symbols ***, **, * denote significance at the 1%, 5% and 10% levels, respectively. DPs refer to dissimilarity parameters. N indicates the product of the number of HQs relocating and the number of potential urban areas for each HQ.

Appendix 7: Correlation table, transformed variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) ln_HQ-specific wage	**1.000**	0.107	0.514	0.369	-0.229	0.140	0.315	0.184	0.391	0.361	0.206
(2) ln_corporate income tax rate	0.107	**1.000**	-0.110	0.163	-0.268	0.177	0.125	0.012	-0.282	-0.102	-0.575
(3) ln_labor income tax rate	0.514	-0.110	**1.000**	-0.095	0.019	-0.231	0.005	0.035	0.014	-0.162	0.362
(4) Large airport	0.369	0.163	-0.095	**1.000**	-0.561	0.585	0.261	0.165	0.546	0.469	-0.146
(5) Medium airport	-0.229	-0.268	0.019	-0.561	**1.000**	-0.141	-0.079	-0.026	-0.128	-0.232	0.087
(6) ln_population size	0.140	0.177	-0.231	0.585	-0.141	**1.000**	0.232	0.135	0.395	0.216	-0.498
(7) ln_HQs overall	0.315	0.125	0.005	0.261	-0.079	0.232	**1.000**	0.531	0.349	0.334	-0.033
(8) ln_HQs in the same industry	0.184	0.012	0.035	0.165	-0.026	0.135	0.531	**1.000**	0.255	0.182	0.028
(9) ln_support service availability	0.391	-0.282	0.014	0.546	-0.128	0.395	0.349	0.255	**1.000**	0.735	0.258
(10) Educated labor pool	0.361	-0.102	-0.162	0.469	-0.232	0.216	0.334	0.182	0.735	**1.000**	0.122
(11) ln_country conditions score	0.206	-0.575	0.362	-0.146	0.087	-0.498	-0.033	0.028	0.258	0.122	**1.000**

Appendix 8: Estimations with a labor pool control variable

Variable	(1)	(2)	(3)	(4)
ln_corporate income tax rate	-2.11***	-2.11***	-1.96***	-1.96***
	(0.46)	(0.45)	(0.44)	(0.46)
Large airport	1.56***	1.54***	1.27**	1.27**
	(0.41)	(0.41)	(0.43)	(0.43)
Medium airport	0.83*	0.82*	0.65	0.65
	(0.33)	(0.33)	(0.34)	(0.34)
ln_distance	-0.68***	-0.67***	-0.60***	-0.60***
	(0.17)	(0.17)	(0.17)	(0.17)
ln_HQ-specific wage	0.66	0.65	0.44	0.44
	(0.36)	(0.35)	(0.33)	(0.33)
ln_population size	-0.70***	-0.69***	-0.54**	-0.54**
	(0.17)	(0.17)	(0.18)	(0.18)
ln_HQs overall	-0.25	-0.24	-0.15	-0.15
	(0.15)	(0.15)	(0.15)	(0.15)
ln_HQs in the same industry	0.77***	0.76***	0.65***	0.65***
	(0.16)	(0.16)	(0.16)	(0.16)
ln_support service availability	1.49***	1.24	1.09*	1.07
	(0.41)	(0.66)	(0.46)	(0.58)
Educated labor pool		0.61		0.076
		(1.34)		(1.19)
DPs				
Nest 1	0.40**	0.38*	0.62***	0.62***
	(0.15)	(0.15)	(0.13)	(0.13)
Nest 2	0.87***	0.85***	0.76***	0.77***
	(0.13)	(0.13)	(0.16)	(0.16)
Nest 3	0.78***	0.79***	0.75***	0.75***
	(0.14)	(0.14)	(0.16)	(0.16)
Nest 4	0.93**	0.89**	0.62**	0.62**
	(0.31)	(0.31)	(0.23)	(0.23)
Nest 5			0.32*	0.32*
			(0.13)	(0.13)
N	12607	12607	12607	12607
LR_IIA	11.9*	12.1*	16.3**	16.3**

Note: Specifications (1) and (2) are region nested and (3) and (4) are language nested. Standard errors in parenthesis. The symbols ***, **, * denote significance at the 1%, 5% and 10% levels, respectively. DPs refer to dissimilarity parameters. N indicates the product of the number of HQs relocating and the number of potential urban areas for each HQ.