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Economic Geography

Anchor Firms in the regional economy

"What is the spatial extent of labor market- and sector effects of anchor firms in the regional economy in the Netherlands?"

Master thesis Economic Geography – University of Groningen

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Title:

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Preface

Dear reader,

This Master thesis concludes my study time at the University of Groningen, at the Faculty of Spatial Sciences to be more precise. After 3-years of Human geography and Urban/Regional Planning (bachelor programme) and 1-year of economic geography (master programme), my stay at this lovely faculty will come to an end. I tried to incorporate most of the knowledge I gathered throughout these years into this master thesis on the spatial-economic dynamics surrounding anchor firms, which has proven to be very interesting, as you will discover reading this piece.

In addition, I would like to thank my supervisor Dr. S. Koster for the feedback throughout the process; it was helpful and much appreciated. Furthermore, I would like to thank the professors at the Economic Geography department for their courses, which also added depth to this thesis. As well as my fellow-students for various discussion sessions regarding (the methodology of) my thesis.

Thank you,

Rik Meendering

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Summary

There has been a lot of debate about the importance of anchor firms to the (regional) economy, either on a national scale for example the discussion on the dividend tax (Dutch: Dividendbelasting) but also on a regional scale in which regional governments aim to either attract and maintain certain firms for the economic benefit of their respective regions. Although literature supports the notion of positive externalities by these firms, it was not known what the spatial extent of these anchor firm externalities were, which can serve as valuable information to these regional governments. Therefore, the following research question was posed:

''What is the spatial extent of labor market- and sector effects of anchor firms in the regional economy in the Netherlands?''

Using the 2016 LISA dataset on firm locations, it was assessed using a rare-event logistic regression how the likelihood of a firm operating in the same sector as the closest anchor firm, relates to the distance from the anchor firm, as this indicates the importance for firms of being located near an anchor firm. In addition, the firm's employment growth rates were related to the distance from the anchor firm using a OLS regression, measuring the spatial extent to which firms observe additional firm employment growth as a result of being located close to an anchor firm.

It is indeed found that the likelihood of a firm operating in the same sector as the closest anchor firm is significantly higher until a maximum of 3 kilometers, until 500 meters the likelihood is even 1,68 times higher compared to firms located over 10 kilometers away from the closest anchor firm. The same pattern emerged from the other analysis concerning the firm employment growth rates, firms located within a maximum of 3 kilometers on average show higher firm employment growth rates, until 500 meters the firm employment growth rate is even 0,65%-point higher compared to firms located over 10 kilometers away from the closest anchor firm.

Therefore, it can be concluded that anchor firm externalities are very localized and on average and do not exceed a range of 3 kilometers. However also sectoral differences were assessed and it was found that firms in knowledge intensive sectors show a different result compared to firms in non-knowledge intensive sectors. Because of the importance of knowledge spillovers, which only transfer over relatively short distances, the anchor firm externalities of knowledge intensive firms are even more localized to a maximum of about 1,5 kilometers.

Keywords: Anchor Firms, Externalities, Knowledge-Spillovers, Proximities

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1. Introduction

Anchor institutions are large organizations that can either be large innovative firms, universities or other public agencies that produce knowledge externalities to the region of the location of the firm (Niosi & Zhegu, 2010). In addition, local firms can serve as a specialized supplier to these anchor firms, highlighting the economic importance of these anchor firms to both the regional innovation system and the regional economy in general (Agrawal & Cockburn, 2003). A well-known example of an anchor firm, especially in the Dutch context, is Philips. A technology firm based in the city of Eindhoven, around which throughout the years other tech-related business have emerged. As a result, the wider Eindhoven region is recognized by the national government as a main port (or brain port) confirming its status as one of the economic core regions of the Netherlands (Ministry of Economic Affairs, 2016). In this thesis, the hypothesis of the anchor firm will be put in the context of Dutch firms making use of the LISA dataset on firm locations. Moreover, more importantly, the geographical reach of the economic effects of the anchor firms will be assessed, since this can affect policy of local and/or regional governments to either invest or disinvest in anchor firms in their respective regions.

1.1 Societal relevance

The geographical reach of the economic effects of the anchor firms are very relevant to local and regional governments. These anchor firms can add a lot of value to the economic base of certain regions; some regions might even depend on one or multiple anchor firms. A prime example of this is the reliance of the City of Detroit (Michigan, United States) on a couple of anchor firms in the automobile industry, most notably Ford Motors (Hannigan et al., 2015). The information on whether the economic effects of a certain anchor firm reach within a particular region, can serve as a justification for governments to either invest or disinvest in these firms. Or facilitate these firms in order to maintain them for the regional economy (Markusen, 1996).

In addition, when a particular large firm, potentially an anchor firm, shows interest to locate in a particular region, policy makers can use this information to evaluate which economic effects adhere to which parts of the region, legitimizing the investment of certain governments, while other governments might abstain from investment. Inditex for example, a fashion giant, showed interest to build a distribution center (creating about 400 jobs) in Lelystad. The municipality of Lelystad recognized this economic opportunity and agreed to facilitate the firm by developing the infrastructure around the site of interest. The province of Flevoland was convinced of the economic benefits for the province, since they offered the company a subsidy of €2,9 million (De Stentor, 2017), because the province thinks that the presence of this firm will enhance the formation of SME's, establishing an ecosystem of suppliers in the province of Flevoland (Province of Flevoland, 2017). The question is however, whether these economic effects will also benefit places outside Lelystad? Raising the question whether the province should have given that subsidy, since the spatial extent to these economic benefits of this particular anchor firm is unknown.

The European Commission (2017) also stresses the importance of anchor firms in the regional economy as they can spark regional development through establishing local networks, which is facilitated by the FRIDA (Fostering Regional Innovation and Development through Anchors and Networks) program. This program focusses on developing policy to effectively use the strength of anchor firms to strengthen the regional economy as a whole, however they acknowledge that there is a 'substantial gap in their understanding' on how the impact of anchor firms, impacts regions differently (CORDIS, 2017). Which might be explained in the difference of spatial extents of the economic effects of anchor firms in different sectors?

1.2 Academic relevance

From an academic perspective, this research is also very relevant. First, the research into the dynamics of anchor firms is in most cases limited to a particular case (firm/institution) or region. Especially, the role of a (research) university as an anchor institution is a popular research topic in this field (Birch et al., 2013; Drucker & Goldstein, 2007) and (Agrawal & Cockburn, 2002). In terms of the anchor firms, the research is often focused on the anchor firms in specific sectors, for example, Niosi & Zhegu (2010) put the anchor firm hypothesis in the context of the aircraft industry across the US. Another example is from Feldman (2003) assessing the anchor firm hypothesis for the Biotech industry also in the US, these are all sectoral approaches. Resulting in very sector- and place specific outcomes, which is valuable information, but these case studies are not generalizable to other regions with different anchor firms and regional characteristics.

Another approach is the regional perspective in which a specific region is taken as a reference to which the anchor firms hypothesis is tested, as is the case in the paper by Rodriguez & Gomez (2012), in which a province of Mexico is assessed, in which they concluded that *''anchor firms generate knowledge spillovers that could be internalized by firms'' (*Rodriguez & Gomez, 2012, p.14). A combination of the two approaches is also possible, as Karlsen (2012) assesses the anchor firm hypothesis in relation to the oil and gas equipment supplier industry in southern Norway, he found that the interaction between the anchor firms and other companies matter in regional innovation systems, since the anchor firms have access to national and international knowledge sources, which is shared to firms in the regional economy stimulating the process of innovation (Karlsen, 2012).

Another issue in this field of research deals with the fact that most papers find (strong) evidence for positive externalities from the anchor firms, but the magnitude of these externalities, as Agrawal & Cockburn put it (2003) remains unclear, because of measurement issues in their data and the unclarity of the mechanisms through which knowledge spillovers were transmitted. Also, Drucker & Goldstein (2007) stress the importance of further research in the spatial extent of the economic development impacts of anchor institutions, since the spatial extent of these economic development impacts of anchor firms might differ from the impacts of an anchor institution (university) in the case of this article. Niosi & Zhegu (2008) on the other hand suggest taking a more generic approach to anchor firms instead of only looking at high technology industries, since *'this will offer a more complete portrait, and*

provide more precise and general conclusions regarding the workings of the anchoring mechanisms' (Niosi & Zhegu, 2008, p.12).

So where does this research fit in? First, this research is positioned in the context of the Netherlands. Anchor firms in relation to the Dutch context are only briefly touched upon in some articles on entrepreneurial ecosystems (Stam, 2014) and business and knowledge ecosystems in which anchor firms play a significant part in generating knowledge, connecting actors *''and actively spur economic growth''* (Otten, 2017, p.4). However, a research centered around the anchor firm hypothesis in the context of the Netherlands is yet to be found. What also makes this research unique is the fact that it has a national scope, the LISA dataset, which includes all locations of all businesses in the Netherlands, allows us to assess the spatial extent to which the economic effects of anchor firms reach on a large scale, rather than looking at just one region or one sectoral cluster, which also sets this research apart from previous work.

1.3 Problem and research goal definition

From previous research, it became clear that anchor firms could have positive effects/externalities to the regional economy (Agrawal & Cockburn, 2003). However, the spatial extent to which these positive effects are present in the regional economy remain unclear (Niosi & Zhegu, 2008) especially in the specific context of the Netherlands. Is the spatial extent of these effects rather limited (local) or do the effects transcend to the wider region? Which is valuable information for policymakers at the local or regional level of government. In addition, from a methodological point of view, it is important that an operational definition is set for anchor firms in the Dutch context, since what sets anchor firms apart from other firms in the Netherlands?

The aim of the research therefore is to find out to what spatial extent the positive effects of anchor firms reach, since this is valuable information to regional governments. Because they can justify investments or disinvestments in these firms, since they might (not) have the positive effects of this particular anchor firm of interest. Ultimately, this research can give a new perspective to both policy-makers and academics on what the importance is of anchor firms in the Dutch regional economy along with the spatial extent to which the positive effects are present, which can be acted upon accordingly

1.4 Research question and sub questions

Based on the problem definition and research aims above, the following research question is proposed:

''What is the spatial extent of labor market- and sector effects of anchor firms in the regional economy in the Netherlands?''

Based on the LISA dataset on firm location, the firm employment growth rates can be derived, also sectoral information on firm level can be found in this dataset. By comparing these characteristics of firms to the characteristics of the closest anchor firm, it can be checked

whether there is a spatial relationship and more importantly in the context of this research question, what the spatial extent is of this possible relationship of overrepresentation of firms from a similar sector experiencing similar firm employment growth rates.

To ultimately answer the research question, the following four sub questions are posed:

''What is the spatial and sectoral distribution of anchor firms in the Netherlands?''

After a definition is set for anchor firms in the Netherlands, the spatial and sectoral distribution of anchor firms throughout the Netherlands can be assessed. Are there particular regions in which a lot of anchor firms are present or is it randomly distributed across the country? In addition, where are these anchor firms exactly located? Are those firms located within the city limits, or just outside the city? Or even in the rural since these firms might need a lot of (cheap) space. Which brings us to the sectoral distribution, since that might be specific to a certain sector? Do anchor firms of specific sectors have different location patterns; are anchor firms in a specific sector overrepresented in a specific region?

'What is the spatial extent of positive externalities from the anchor firm in terms of the sector structure of related firms?'

In addition, sectoral information is available is the LISA dataset. This sector information of individual firms can be compared to the sector characteristic of the anchor firm. Why can a similar sector characteristic be observed as an indicator for the positive externalities of anchor firms? This hypothesis is built on the fact that there might be localization economies present as a result of the location of the anchor firm (Marshall, 1920). Given the sector of the anchor firm, it is expected that nearby firms are more likely to be operating in a similar sector.

'What is the spatial extent of positive externalities from the anchor firm in terms of firm employment growth of related firms?'

As already mentioned, firm employment growth rates can be derived from the LISA dataset. These firm employment growth rates of individual firms can be compared to the firm employment growth rate of the respective anchor firms. Why can similar firm employment growth rates be observed as an indicator for the positive externalities of anchor firms? This hypothesis is built on the fact that there might be some sort of supplier effect between the anchor firms and specific other firms in the vicinity (Heide & Stump, 1995). If the anchor firm is experiencing a given employment growth rate, it is expected that suppliers to this anchor firm are more likely to experience similar employment growth rates.

''What are the sectoral differences in the spatial extents of the labor market- and sector effects?''

Based on information from the previous sub questions, some sectors require more suppliers and/or are involved in more or less knowledge intensive industries, it would not be unlikely that the spatial extent of the positive externalities of anchor firms in would differ per sector in both the labor market effects as well as the sectoral effects.

1.5 Reading Guide

In the following chapter, a theoretical framework is constructed related to the research questions posed in this introduction, which will be concluded by a conceptual model and a number of hypotheses to be tested in the analysis of this thesis. After a methodology is set out to provide a framework for these hypotheses to be tested using GIS (Geographical Information Systems) and regression analysis along with a reflection on this methodology. After which the results of the analysis are presented and discussed in relation to theory. Finally, conclusions will be drawn, and the research questioned will be answered and reflected upon in the discussion section.

2. Theoretical framework

This theoretical framework will consist of multiple concepts and theories to place this research in the context of existing academic literature. First, the anchor firm hypothesis, along with its dynamics will be discussed, which will eventually be put in the wider context of localization and urbanization economies. In relation to this, the theory of proximities is discussed linking geographical proximity to other features of proximity. Another important aspect are the labor market dynamics focused towards the movements of employees switching jobs and starting firms themselves. Thereafter, the dynamics of distance decay relationships between a source, an anchor firm in this case, and the effects are reviewed and linked to previous research on distance effects of (knowledge) externalities. There will be concluded with a conceptual model in which all concepts are put in the right relation to each other.

2.1 The anchor firm hypothesis

Anchor firms can be seen as an agglomerative force, stimulating the formation of new firms, economic growth and specialization of a cluster (Feldman, 2003). According to Feldman, anchor firms attract skilled labor pools, specialized intermediate industries (suppliers) and provide knowledge spillovers, creating an environment in which new specialized firms related to the anchor firm can emerge, possibly founded by former employees of anchor firms who may take ideas with them from the anchor firm (Klepper, 2001). The fact about this type of entrepreneurship is that these firms do not move to other places but remain in the regional economy (close to the anchor firm) in order to benefit from existing local networks (Feldman, 2001). Eventually, this can lead to a process of innovation spurring regional economic growth (Feldman, 2003). In terms of definition, anchor firms must have some degree of the following characteristics based on Agrawal & Cockburn (2003):

- Large firm
- Roots in regional economy (local presence)
- R&D-orientation

The anchor firm needs to be of a substantial size since it then benefits from Schumpeterian economies of scale, meaning that the relative cost of investing in R&D are lower, since it can utilize it over multiple projects (Agrawal & Cockburn, 2003). A local presence of the anchor firm is required because externalities generated by the anchor firm are derived from the spatial proximity of other firms, while transaction costs of knowledge must be low, since tacit knowledge is transferred through personal interaction. Finally, some degree of R&D-orientation is required since; it is unlikely that a firm would have a major impact on the respective market without the ongoing development of their products (Agrawal & Cockburn, 2003).

2.2 Urbanization economies

Historically, urbanization economies were defined as economies of scale external to any industry and resulting from the general level of city economy (Hoover, 1937). However, this definition has shifted towards a notion of urban diversity, in which urbanization economies are defined *'as benefits that firms obtain from both the overall scale and diversity of a city'* (Henderson et al., 1995, p.1068). Common ground of these and other definitions is that these economies are not sector specific and they accrue to all firms across different sectors. As mentioned, urbanization economies consist of two components: a scale component, which are the benefits derived from the scale of the city or economic cluster in this context. A relevant example of this is that the fiber-optic network for high-speed internet-access can be cheaper established in high-density areas, because of lower relative costs, as the costs are divided by all actors benefiting from this network. In addition, (anchor) firms require services from other firms that are not per definition sector specific for example legal, real estate and educational services, but also services like marketing, advertising and catering, which are more available in higher density areas opposed to lower density areas.

The other component is the diversity component which is posed by Jane Jacobs (1969), which is also related to the localization economies, however Jacobs argues that knowledge spillovers are taking place through Jacobs externalities (Jacobs, 1969). These Jacobs externalities in the context of urbanization economies can best be described as the unrelated variety between sectors (Frenken et al., 2007). The creation of knowledge occurs because of (agents from) firms meet in either a formal or informal context and share ideas that are common in their own respective sectors but might be a breakthrough in the others sector, leading to the creation of knowledge and thus innovation. Put otherwise there should be a sufficient cognitive distance, as otherwise firms can't learn from each other since they both have the same knowledge already. Relating back to urbanization economies, such knowledge spillovers are more likely to occur in an urbanized setting because of the size but foremost diversity in urban areas (Jacobs, 1969) or other areas with a high density of economic activity (clusters).

In this perspective of anchor firms also requiring third party services like accountants, lawyers and infrastructure. Along with the fact that anchor firms can also benefit from the economies of scale and Jacobs externalities (Jacobs, 1969) it seems likely that anchor firms are more likely to be located in an urban setting, which is the first hypothesis of this thesis.

'Hypothesis 1: Anchor firms are relatively overrepresented in urban areas'

2.3 The role of distance (proximities)

A possible explanation for this can be found in the research of Boschma (2005) discussing the proximities and innovation. He claims that geographical proximity *'is neither a necessary nor a sufficient condition for learning to take place'* (Boschma, 2005, p.62). However, geographical proximity is a facilitator of this learning process, through strengthening the other dimensions

of proximity: cognitive, organizational, social and institutional proximity (Boschma, 2005), which will be discussed below in relation to the anchor firm hypothesis.

2.4.1 Cognitive proximity

Firms in search of opportunities to further improve their business, search in close proximity to their own knowledge base. The creation of knowledge and innovation can be seen as localized outcomes of search processes with a high degree of tacit knowledge (Boschma, 2004). However, the transfer of knowledge from one firm to the other is dependent on an absorptive capacity to identify, interpret and exploit this new knowledge (Cohen & Levinthal, 1990). Therefore, cognitive distance should be close enough to the source of knowledge to either communicate, understand and process this new knowledge successfully (Boschma & Lambooy, 1999). On the other hand, cognitive distance should not be too limited, since this may lead to a cognitive lock-in, a situation in which routines within a firm '*obscure the view on new technologies or new market possibilities'* (Boschma, 2005, p.64).

2.4.2 Organizational proximity

The creation of knowledge is not only dependent on this cognitive proximity, but also on the capacity to coordinate and exchange these complementary sources of knowledge owned by various actors between firms (Boschma, 2005). According to Cooke and Morgan (1998), organizational arrangements or networks are mechanisms that coordinate transactions of goods, but also transfers information and knowledge between firms. Since the creation of knowledge can be uncertain or even risky, an organizational proximity, defined as *'the extent to which relations are shared in an organizational arrangement, either within or between organizations'* (Boschma, 2005, p.65), can reduce this risk by through strong control mechanism to ensure ownership rights and the insurance of sufficient rewards for investments in new technologies. In addition, in strong organizational units the creation of knowledge is enhanced through feedback mechanisms between of the strong ties of the actors involved in the organizational network (Hansen, 1999). However, also in terms of organizational proximity the risk of a lock-in is present. Asymmetric relationships due to size-differences between firms can result in hold-up problems, because of a high-dependency on the leading actor in the network (Boschma, 2005). This notion is particularly interesting considering the anchor firm hypothesis since the anchor firm is a leading (big) firm, which is supposed to have a presence in the regional economy involving the relationships with other (smaller) firms. In addition, risks of an inward-looking system, bureaucracy and lack of organizational flexibility can limit the transfer of knowledge in a system in which the organizational proximity is too close (Boschma, 2005).

2.4.3 Social proximity

Social proximity is defined as socially embedded relations between agents at the micro-level. These relationships between these agents are socially embedded as trust is built on friendship, kinship and experience (Boschma, 2005). Trust-based relationships facilitate the exchange of tacit knowledge (Maskell & Malmberg, 1999), and '*encourages an open and social attitude of communicative rationality rather than a calculative and narrow market orientation towards cost-minimization'* (Lundvall, 1993, p.54). Too much social proximity on the other hand limits

knowledge transfer. Since in too embedded relationships, there is a risk of underestimation of opportunities and *in long-term relationships, there is a risk lock-in of agents' doings things in established ways at the expense of their own innovative and learning capacity* (Boschma, 2005, p.66).

2.4.4 Institutional proximity

Although organizational, social and institutional proximity are strongly interconnected, institutional proximity is assessed at the more macro-level and can be defined as: '*a set of common habits, routines, established practices, rules or laws that regulate the relations and interactions between individuals and groups'* (Edquist et al., 1997, p.46). Boschma (2005) re-categorizes this as formal (laws and rules) and informal institutions (cultural norms and habits) as these institutions influence the ways in which firms coordinate their actions, as for example the transfer of knowledge and thus innovation. However, institutional proximity can also be a constraining factor as the mutual interdependence of parts of the institutional system can cause local inertia, since innovation (changes) brings instability, powerful institutional players react in a routinized and conservative way, to secure their position resulting in no or limited changes at the local level (Grabher, 1993). It also, can limit the opportunities of newcomers that further limits the development of innovation as the required build-up or restructuring of old institutional structures is hindered (Freeman & Perez, 1988), this institutional rigidity leaves little room to experiment for the successful implementation of new ideas and innovations (Boschma, 2005).

2.4.5 Geographical proximity

Geographic proximity can be defined in a very restricted manner as the spatial distance between economic actors, in an absolute or relative meaning. In this thesis, this would be the (relative) distance between the anchor firms and other related firms. A short distance can bring people together, which favors the transfer of information and tacit knowledge. A larger distance on the other hand leads to a lower intensity of these externalities and the transfer of tacit knowledge (Boschma, 2005). Even codified knowledge as it requires interpretation and assimilation (tacit knowledge) and in effect a spatial closeness (Howells, 2002). Empirical evidence shows that firms near a source of knowledge, which can be an anchor firm in our context, have a better innovative performance than firms that are located further away, suggesting that knowledge externalities are geographically bounded (Audretsch & Feldman, 1996).

As previously mentioned, geographical proximity *'is neither a necessary nor a sufficient condition for learning to take place'* (Boschma, 2005, p.62). Geographical proximity itself barely improve the interactive learning processes that lead to innovation. For example, if the geographical distance between two firms is close but if these firms have a large cognitive distance because they operate in very different sectors, it is more unlikely that there are common grounds that allow for an effective transfer of knowledge from one firm to the other.

However, geographical proximity can be as a complement or facilitator to the other forms of proximity in the process of interactive learning (Boschma, 2005). Firms located in close spatial proximity are more likely to have face-to-face contacts, which can build trust between agents

and lead to more personal and embedded relationships between firms (Harrison, 1992). In addition, the formation and evolution of institutions is improved by a close geographic proximity, which can also serve as a bridge to a knowledge gap between firms (cognitive proximity) (Freel, 2003). Again, there is a risk for a spatial lock-in or lack of geographical openness to the outside world, since routines and competences between firms can convergence within regions instead of between regions, this is caused by local processes of imitation and selection (Boschma, 2005), resulting in an erosion of agglomeration economies including knowledge externalities, which can be avoided by the establishment of non-local relationships providing access to the 'outside world', as knowledge creation requires a balance of local and non-local relations (Asheim & Isaksen, 2002). In addition, the local knowledge base can be diversified (Jane Jacobs externalities) to avoid the problems regarding a spatial lock-in (Boschma, 2005).

2.4 Localization economies

The proclaimed externalities of an anchor firm are very similar to the concept of localization economies first described by Alfred Marshall in his book the '*principles of economics'* (1920). Localization economies are benefits for a firm derived from the presence of other firms belonging to the same industry in a particular area (Jofre-Monseny et al., 2012). According to Marshall (1920), these localization economies consists of:

- Access to skilled labour pool
- Presence of specialized suppliers
- Knowledge spillovers through competing firms

Resulting in a competitive locational advantage for firms to improve the access to these key resources. These localization economies are also present in the anchor firm hypothesis, which is built on the interaction between the anchor firm itself along with the related businesses. These businesses also benefit from the skilled labor force that is attracted by an anchor firm, the businesses can act as a specialized supplier to the anchor firm, and lastly knowledge is transferred between firms, which spurs innovation and regional economic growth (Fritsch & Franke, 2004).

So, through what mechanisms and institutions are those externalities transferred from the anchor firm to the other (smaller) firms? A very important question in relation to our hypothesis that there is a maximum spatial extent to these externalities. Based on the externalities derived from localization economies and the previous discussion on proximities the second hypothesis is posed, stating that: firms located close to the anchor firms are more likely to be operating in the same sector.

'Hypothesis 2: **'The likelihood of a firm operating in the same sector as the anchor firm declines, as the distance between the firm and anchor firm increases'**

2.5 The role of labor market dynamics

Another role that cannot be ignored in relation to the transfer of externalities is the role of the employee, as already mentioned in the literature of proximities by Boschma (2005) externalities are transferred through agents (employees) of firms, in short it is the people working at firms instead of the firm itself (in its most limited sense) that is responsible for the transfer of externalities, knowledge that may lead to innovation.

2.5.1 Labor mobility

Employees however are not fixed to their firms, there might be contracts involved, but to a major extent, employees are free to quit their jobs and seek employment somewhere else. This job mobility, which is defined as *'the pattern of intra- and inter-organizational transitions over the course of a person's work life'* (Hall, 1996, p.10), is one of mechanisms through which externalities are transferred. In recent decades, Individuals are more focused on '*obtaining a variety of work experiences and knowledge across jobs and organizations'* (Bird, 1996, p.328) every work-related move is targeted towards an improvement of the knowledge and skill set. Put otherwise, an employee of firm A improves his knowledge and skills at this firm, then he takes on a new job at firm B and makes use of his knowledge learned at firm A, which may lead to new insights at firm B, possibly leading to innovation.

Face-to-face interaction is the key in the transfer of knowledge, especially in sectors that do not rely on patenting their innovations (IT), Draca et al. (2006) even argue that the transfer of knowledge among firms is not just done by the job mobility of employees but also through contractors and consultants (third parties) which either firm has a business relationship with (Draca et al., 2006).

2.5.2 Spinoffs

Another labor market dynamic that seems even more important in light of anchor firms are former employees that start their own firms, which are known as employee start-ups or spinoffs. These spinoffs are in most cases founded by *'well-educated and experienced employees of similar technologies and markets'* (Cooper, 1986, p.162). A common heard analogy for starting a spinoff is that these employees have become frustrated with their former employer Garvin, 1983), often concerning having differences over new ideas and the direction of the firm (Klepper & Sleeper, 2005).

Anchor firms, being established and large firms, can be inflexible, unwilling or too slow to pursue new niche markets or technologies in order not to take unnecessary risk and maintain their market position. This is the gap which is filled by spinoffs, *'which exploit the knowledge of their founders acquired from the anchor firm'* (referred to as 'parent') in order *to pursue ideas involving new niche markets or technologies* (Klepper & Sleeper, 2005, p.1291). Additionally, in case that spin-offs turn successful, other firms including the parent firm start to imitate the successful spinoff (Klepper, 2007), this may also lead to a supplier relationship between the (parent) anchor firm and the spinoff, in which the spinoff becomes responsible for a certain part of the production (of knowledge).

In this perspective of spin-offs having a supplier relationship to the anchor firm along with the fact that former employees make use of knowledge gathered at the anchor at their new jobs, most likely in the same sector. A third hypothesis is posed, similar to the second hypothesis of '*the likelihood of a firm operating in the same sector as the anchor firm declines, as the distance between the firm and anchor firm increases'*, stating that:

'Hypothesis 3: 'The likelihood of a firm experiencing similar firm employment growth rates as the anchor firm declines, as the **distance between the firm and anchor firm increases'**

2.6 The role of the sectoral structure

Recalling the Marshallian forces of localization economies of a skilled labour pool, specialized suppliers and knowledge externalities, it would not be surprising if various sectors benefit to a greater or lesser extent from these externalities, since some sectors are less reliant on labour, but are capital-intensive, in which case specialized suppliers become more important. Similarly, some sectors are not that knowledge intensive as others, meaning that the importance of knowledge externalities (and localization economies in general) differs from one sector to another sector (Frenken et al., 2006). Put otherwise: sectors that are more reliant on a skilled labour pool, specialized suppliers or knowledge will be more likely to be clustered.

All these externalities seem to have different spatial ranges, which marks the effects influencing the extent of clustering. According to Andersson et al. (2016) the effect of knowledge externalities is sharply attenuated with distance, since it is transferred through localized non-market interaction effects, which was captured in a neighborhood effect, reaching not further than only one kilometer in their research (Andersson et al., 2016). In terms of the specialized supplier effect Andersson et al. (2016) argue that this effect is not bound to such a close geographical proximity but is more likely to extent to a city-area range of the Stockholm area in their case study. Malmberg & Maskell (2002) also stress that knowledge spillovers are present at a lower local degree opposed to a skilled labor pool and the presence of specialized suppliers.

There is a lot of discussion what the spatial extent is of a skilled labour pool. Some argue that it can range as far as the commuting distance, since workers are still part of a system of networked and interacting agents (Anselin et al., 2000). Which makes sense, since people who are willing to commute to certain cluster for employment is indeed part of the (skilled) labor pool that this cluster is benefitting from. However, Paci & Usai (2000) argue that labor forces are contained or geographically bounded by the cluster suggesting a smaller spatial extent of labor pooling since workers are almost solely focused on employment in that particular cluster.

As previously mentioned the degree to which clusters but also anchor firms rely on elements like knowledge spillovers, specialized suppliers and labour pooling determine the spatial extent of the positive externalities these firms have, since different sectors rely differently on

these elements it would not be unlikely that the spatial extent of positive externalities of anchor firms would differs from sector to sector. An analogy that is already confirmed to some extent by Spencer (2013). In this research the proximity to anchor firms of firms in four industries in the US and Canada (Food Industry, Car Manufacturing, ICT Manufacturing and Bio-pharma Industry) is analyzed, also in relation to clustering of these particular sectors. He found that the ICT-manufacturing (60%) and Bio-pharma industry (52%) were more clustered around the anchor firm than the food (48%) and car-manufacturing (44%) industries, since these sectors are less focused towards transactional/logistical relationships between firms but rely on other factors like a shared (labor market) institutions and knowledge spillovers (Spencer, 2013).

Based on the fact that knowledge spillovers are present over a smaller spatial extent opposed to externalities concerning specialized suppliers and a skilled labor pool. The final hypothesis is stated that: The spatial extent of externalities from the anchor firm is smaller for knowledge-intensive sectors as opposed to labor-intensive sectors.

'Hypothesis 4: The spatial extent of externalities from the anchor firm is smaller for knowledge-intensive sectors as opposed to non-knowledge intensive sectors'.

2.7 Distance decay relationships

According to Malmberg and Maskell (2002), the various mechanisms behind the creation of knowledge and innovation are not occurring at one spatial level but operate across different spatial scales at the same time. Whereas inter-firm networks tend to operate at an aggregate spatial scale, the mechanisms of knowledge transfer, such as spin-off dynamics and labour market mobility, seem to operate at a more local level (Boschma, 2005). This implies a different distance decay across different mechanisms of knowledge transfer and thus effect of anchor firms in our context. Distance decay relationships start with the notion that: *'everything is related to everything else, but near things are more related than distant things'*, known as the first law of geography (Tobler, 1970, p.237). A related term is the friction of distance, which supposes that a distance needs to be overcome by resources like energy, time and effort (Rengert et al., 1999). Therefore, spatial interactions are more likely to occur in close spatial proximity in both quantitative terms (amount of interactions) and qualitative terms (intensity of interactions). Another model that tries to explain the number of spatial interactions between two places or actors (firms) is the gravity model, one version of this model is posed by Ullman (1954) in the context of international trade explaining trade flows between countries. Which implies that the level of interaction between location A and location B can be explained from the size difference between the two locations (in terms of population size) divided by the spatial distance between these locations in which also an impedance factor is taken into account, such as a (inter)national boundary, a physical boundary, like a mountain range or a body of water (Ullman, 1954). Relating this to the anchor firm hypothesis, taking firm size instead of population size, one might argue that the interactions between anchor firms, having a lot of employees, in relation to other firms are

high over a short distance, adding to our hypothesis that the spatial extent of positive externalities by the anchor firm is rather limited. The distance decay function of such a relationship involving distance can best be characterized by a negative exponential function (Nekola & White, 1999), in which interaction between firms is high over short distances, whereas interactions are rapidly (exponentially) decreases as firms are located further away from each other.

2.8 Conceptual framework

Based on the concepts and theories summarized in the previous part of the theoretical framework the following conceptual model is constructed as can be seen below in figure 1. This model shows the relationship between an anchor firm and other firms, through the concept of geographic proximity (Boschma, 2005) and the various effects that influence the spatial extent of this geographical component that relates back to the research question of:

''What is the spatial extent of labor market- and sector effects of anchor firms in the regional economy in the Netherlands?''

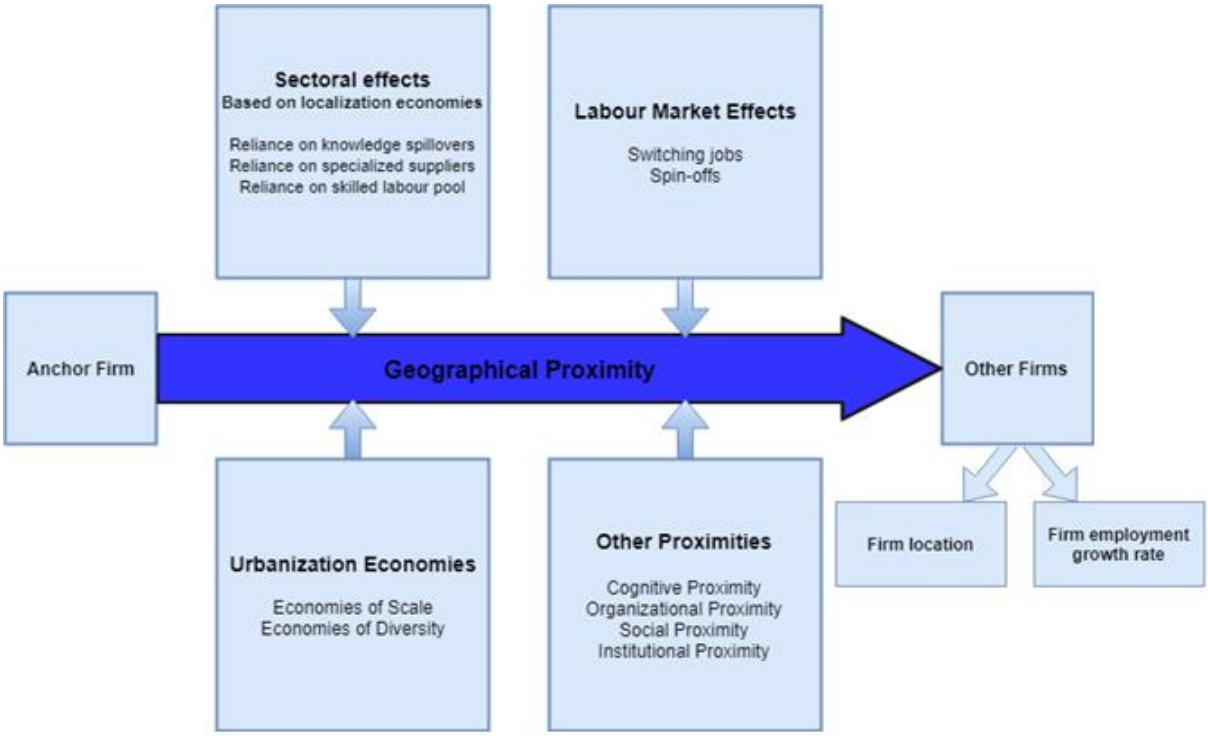

Figure 1: Conceptual framework

To take the model in a little more depth. On the left side of the model is the anchor firm, based on the literature we found that these firms have a specific importance and benefits to other firms in the regional economy. Which brought us to the question what the spatial extent is of these benefits, put otherwise: what is the maximum geographical proximity that still allows for externalities to be transferred from the anchor firm and other firms? Which relates back to the research questions posed in the introduction of this thesis.

Moreover, what are the determinants for the spatial extent of the externalities of the anchor firm?

First, there are sectoral effects present, as different sectors rely differently on localization economies, it is not unlikely that anchor firms from different sectors have a different spatial extent to the externalities as the different types of localization economies have different spatial extents (Andersson et al., 2016; Malmberg & Maskell, 2002: Anselin et al., 2000).

Secondly, there are labor market effects concerning the labor mobility of former employees of (anchor) firms and former employees that start their own (related) business (spinoff) to pursue ideas involving new niche markets or technologies, which were not pursued by the parent firm (Klepper & Sleeper, 2005).

Thirdly, the presence of urbanization economies consisting of economies of scale as anchor firms, being a large firm the relative 'costs' of infrastructure, presence of third party services becomes lower, with the presence of a large (anchor) firm. Also, there are economies derived from the diversity of being located close to a variety of other firms, as there is a sufficient cognitive distance (Boschma, 2005) in order to learn from each other through informal meetings (Jacobs, 1969)

Finally, the spatial extent of externalities is influenced by other proximities. If there are large, however bridgeable, proximities between firms in case of for example cognitive proximity, this can be compensated by a closer geographical proximity as (agents of) firms can meet more often and by doing so bridge the knowledge gap (decrease the cognitive proximity) over time (Boschma, 2005).

3. Methodology

The following methodology is proposed. First, the operationalization of the research is discussed, after which the data availability is discussed along with the procedures of the data-analysis itself, followed by a brief discussion on the variables of interest. In addition, attention is brought to the data requirements and more importantly the necessary preparations, using GIS, to successfully conduct the analysis. Finally, the reliability and validity of the research will be reflected upon.

3.1 Operationalization of the research

What information is needed the answer the research questions? One of the central questions in this methodology is: 'Which firms qualify as an anchor firm?' As previously discussed in the theoretical framework, the anchor firm definition is not unanimously agreed upon and has multiple assets, like having a large employment base, having a significant presence in the regional economy and having a focus towards research and development (Agrawal & Cockburn, 2003). These multiple assets of the definition also lead to differences in terms of the operationalization of the definition, as multiple operationalization's are used in anchor firms research, focusing either on a large employment base or the orientedness towards R&D. Spencer (2013) draws an employment threshold of 500 employees since this represents *'the very high end of the total business universe'* in the Canadian context *(Spencer*, 2013, p.8). Another distinction is made based on the number of patents, as Agrawal & Cockburn (2003) take a threshold of 500 patents to determine which firms qualify as anchor firm, to also include the aspect of knowledge-intensity. However, since employees play an important role in the transfer of externalities between firms (Boschma, 2005), a cut-off point is determined based on the number of employees a firm has.

The cut-off point for the Netherlands in this research is determined at the mark of 248 (top 0,2%) employees, based on k-means cluster analysis. This method *'attempts to identify homogeneous groups of cases based on selected characteristics'* (IBM, 2018). In this case, the characteristic is the number of jobs at the firm level. The K-means cluster analysis resulted in a series of potential cut-off points, since anchor firms are operationalized as large firms in this thesis, the cut-off point of 248 was chosen since the gap to the previous and next potential cut-off point was larger compared to the earlier cut-off point candidates, suggesting that a 'new' type of firms become present in the data from that point onwards.

However, since this cut-off point remains arbitrary to some extent, the analysis will be re-run twice, to test the robustness of the determined cut-off point, using different cut-off points determined at 194 (top 0,29%) and 299 (top 0,16%) employees, which represent other (adjacent) cut-off points resulting from the K-means clustering analysis.

Resulting from this selection, anchor firms are present across the following sectors, as can be seen from table 1 on the next page, which gives an overview of the sectoral distribution across anchor firms, for reasons of clarification this summary is given on the 1-digit SBI-level, the analysis however is carried out on the 2-digit SBI-level in order to capture the sectoral effect better, which will be elaborated on in the next section.

Sector:	# Anchor firms (194)		**# Anchor firms (248)**		# Anchor firms (299)	
Manufacturing (C)	756	14%	**551**	**14,4%**	423	14,6%
Energy (D)	64	1,2%	**42**	**1,1%**	33	1,1%
Water & Waste Management (E)	52	1%	**26**	**0,7%**	17	0,6%
Construction (F)	168	3,1%	**97**	**2,5%**	57	2%
Retail (G)	403	7,5%	**230**	**6,1%**	161	5,6%
Logistics (H)	391	7,2%	**260**	**6,8%**	166	5,7%
Hospitality (I)	57	1,1%	**36**	**0,9%**	22	0,8%
Information & Communication (J)	207	3,9%	**163**	**4,3%**	129	4,4%
Finance (K)	212	3,9%	**173**	**4,3%**	141	4,9%
Real Estate (L)	14	0,3%	**6**	**0,2%**	3	0,1%
Consultancy, Research & Business services (M)	341	6,3%	**257**	**6,7%**	195	6,7%
Renting & Other Business Support Services (N)	315	5,9%	**233**	**6,1%**	193	6,7%
Public Administration (O)	753	14%	**567**	**14,8%**	439	15,1%
Education (P)	337	6,2%	**213**	**5,6%**	156	5,4%
Healthcare (Q)	1224	22,7%	**910**	**23,8%**	724	24,9%
Culture, Sports & Recreation (R)	56	1%	**32**	**0,8%**	22	0,8%
Other Service Activities (S)	39	0,7%	**22**	**0,6%**	18	0,6%
Domestic Services (T)	0	0%	**0**	**0%**	0	0%
Total	5389	100%	**3818**	**100%**	2899	100%

***Agriculture, forestry and Fisheries (A), mining and quarrying (B) & extraterritorial organisations and bodies (U) excluded (CBS, 2015)**

Table 1: Sectoral distribution of Anchor Firms (LISA, 2016)

Table 1 above clearly shows that the incidence of anchor firms is highly skewed across sectors, three sectors (Manufacturing, Public Administration and Healthcare) alone are responsible for 53% (!) of all anchor firms in this sample. While in other sectors (for example: domestic services, real estate) there are virtually no anchor firms in this very sample. This raises the question what makes these three sectors so different in terms of operations in relation to their size in terms of number of employees working in these firms? In addition, how does this influence the spatial extent of the anchor firms' effects? These questions will be answered in sections 4.1.1. and 4.4 in which the sectoral distribution of Anchor Firms as well as the sectoral differences in the spatial extent of the anchor firm' externalities will be analyzed.

The industry in which both the anchor firms and related firms are active is easily operationalized as this data is available in the LISA dataset on the 2-digit SBI-level and can be transformed to either active or not active in similar sector as the related anchor firm.

Another distinction can be made between firms operating in sectors carrying out knowledge intensive activities (KIA's) in which over a third of the total employment in these sectors is tertiary educated (Eurostat, 2018) and other firms that are not labelled as such. Based on this distinction, it will be possible to analyze whether there are differences in distance effects between these different sector-types. Based on the 2-digit SBI-codes, the following sectors are denoted as knowledge intensive activities in table 2 on the next page (Eurostat, 2018):

NACE Rev. 2 codes	Description
19	Manufacture of coke and refined petroleum products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
26	Manufacture of computer, electronic and optical products
51	Air transport
58	Publishing activities
59	Motion picture, video and television programme production and pharmaceutical preparations
60	Programming and broadcasting activities
61	Telecommunications
62	Computer programming, consultancy and related activities
63	Information service activities
64	Financial service activities, except insurance and pension funding
65	Insurance, reinsurance and pension funding, except compulsory social security
66	Activities auxiliary to financial services and insurance activities
69	Legal and accounting activities
70	Activities of head offices; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development
73	Advertising and market research
74	Other professional, scientific and technical activities
75	Veterinary activities
78	Employment activities
79	Travel agency, tour operator reservation service and related activities
84	Public administration and defence; compulsory social security
85	Education
86	Human health activities
90	Creative, arts and entertainment activities
91	Libraries, archives, museums and other cultural activities
94	Activities of membership organisations

***Agriculture, forestry and Fisheries (A), mining and quarrying (B) & extraterritorial organisations and bodies (U) excluded**

Table 2: List of sectors denoted as knowledge intensive activities (Eurostat, 2018)

In terms of labor market effects, it is a little more complicated. As the LISA dataset has been available throughout the years, firm employment growth rates of either the anchor firms as well as the related firms can be calculated. Considering one of the hypotheses that firms are expected to experience similar firm employment growth rates as the related anchor firm, labor market effects are operationalized as the relationship between the firm employment growth rates of firms in relation to the firm employment growth rate of the related anchor firm.

Finally, the firm employment growth rates are computed based on the number of employees in 2008 and 2016. However, it occurs that firms are founded or went bankrupt in this time-period, and therefore firms are not present in the dataset for one of the respective years. A simple, yet incorrect, solution would be to exclude these firms, however these firms were present in the regional economy for a certain number of years and cannot be ignored, so exclusion is not an option. Therefore, average annual firm employment growth rates are taken as an alternative, meaning that firms appearing in the dataset at least 2-times between 2008 and 2016 are included in the analysis. Only firms having just one entry during that time period are excluded since no employment growth rates can be derived for these firms, although this is unfortunate, these firms were only present in the regional economy for a limited time (< 1 year).

3.2 Data availability

The core dataset of this analysis consists of the LISA dataset, LISA stands for 'Landelijk informatiesysteem van Arbeidsplaatsen', which (loosely) translates to 'National Labor Information System'. This dataset consists of all locations in the Netherlands where paid labor is conducted (over 1,5 million locations in 2016), it combines the spatial component of an address and links it to economic components like firm size, industry and employment characteristics (LISA, 2018).

Another dataset of interest is 'Het Nationaal Wegenbestand Nederland (NWB)', National Road database in English. Since, geographical distance is the key attribute to assess in this research it is important to analyze it properly by assessing the network distance between the anchor firms and related firms instead of Euclidean distance, in order to do so the NWB Dataset is needed to perform these distance calculations.

Finally, some additional datasets are used mostly in relation to the control variables, since there must be controlled for other locational factors apart from being geographically close to an anchor firm, these would be distances, derived using the NWB of other points of interests (highways, airports), but also local characteristics derived from the 'CBS Postal code Data' neighborhood data) and other data from the CBS, which will be discussed in more depth later.

3.3 Data-analysis

In the following section, the data-analysis is discussed, structured based on the sub questions posed in the introduction of this thesis, which will eventually lead to the answering of the main research question in the next chapter.

3.3.1 Sub Question 1: *'What is the spatial and sectoral distribution of anchor firms in the Netherlands?*

In order to answer the first sub question, a number of GIS maps need to be generated. First, the overall spatial distribution of all anchor firms, disregarding sector, needs to be mapped. This will result in a heat map based on point density in which areas with relatively many anchor firms are highlighted.

Thereafter, a map will be generated in which there has been a differentiation based on the different sectors, this allows us to draw conclusions whether anchor firms of different sectors show distinctive location patterns. Moreover, a map will be presented in which the relative importance of anchor firms to the regional economy is displayed in terms of employment. A sectoral distribution of the number of anchor firms can already be found in the operationalization section of this methodology.

3.3.2 Sub Question 2: *'What is the spatial extent of positive externalities from the anchor firm in terms of the sectoral structure of related firms?'*

In order to answer the second sub question, a rare-event binary logistic regression analysis is carried out. The dependent variable is a binary variable indicating whether the most nearby anchor firm is operating in the same sector as the related firm or not. As this event, the firm and closest anchor firm both operating in the same sector, is binomially inflated meaning that the particular event is very rare, only occurring in 2,65% of the cases, this special extension of the binary logistic regression is added to the analysis as it corrects for the extreme rarity of the event resulting in more precision in the coefficients resulting from the regression analysis.

Based on theory it is expected that nearby firms are more likely to be operating in the same sector. Therefore, the distance to the anchor firm is included as the main explanatory variable in this binary logistic regression. In order to correct for other (distance) effects, a set of control variables is included, for example, the distance to second nearest anchor firm, a full synthesis of the control variables can be found in the section on variables of interest in the next section.

3.3.3 Sub Question 3: *What is the spatial extent of positive externalities from the anchor firm in terms of firm employment growth of related firms?*

In order to answer the third sub question, an Ordinary Least Squares (OLS) linear regression analysis is carried out. The dependent variable is the annual firm employment growth. Since, it is expected that this annual firm employment growth rate is similar to the annual firm employment growth rate of the nearest anchor firm. This is included as an explanatory variable, along with a distance variable indicating the distance to the nearest anchor firm. In order to correct for other (distance) effects, a set of control variables is included, for example the distance to 2nd nearest anchor firm and the distance to a highway, a full synthesis of the control variables can be found in the section on variables of interest in the next section.

3.3.4 Sub Question 4: *''What are the sectoral differences in the spatial extents of the labor market- and sector effects?''*

In order to answer the fourth sub question, both regression analyses of the previous sub questions are repeated with the difference that these are rerun twice: first only including the firms operating in non-knowledge intensive sectors and secondly only including firms operating in knowledge-intensive sectors as described in the operational section of this methodology.

3.4 Variables of interest

In the following section the variables of interest are discussed that are of importance for the analysis. First, the dependent variables are discussed, the second part will focus on the explanatory variables. This section will be concluded with a discussion on control variables.

3.4.1 Dependent variables

The first dependent variable in this research, concerning the second sub question, is the binary variable indicating whether the firm is operating in the same sector as the related anchor firm. The choice for the variable is based on the hypothesis that firms located close to the anchor firms are more likely to be operating in the same sector as the anchor firm. Because these firms can, as a result, benefit from localization economies that are related to the presence of the anchor firm operating in the same sector as the firm in question.

The second dependent variable in this research, concerning the third sub question, is the firm employment growth rate. The choice for the variable is based on the hypothesis that firms located close to the anchor firms are more likely to experience similar firm employment growth rates as the anchor firm. Since, it is likely that specialized supplier relationships have emerged between the anchor firm and (spinoff) firms in the near vicinity along with the fact that knowledge from the anchor firms is transferred and utilized/monetized by other firms through the labor mobility of former employees. For those reasons, it seems more likely that firms close to the anchor firm show similar firm employment growth rates.

3.4.2 Explanatory variables

The most important explanatory variable in this research is the distance to the closest anchor firm measured in meters based on network distance. As the main research question is related to the spatial extent of the externalities of anchor firms, this variable captures this spatial component in terms of a distance effect. Since, it is likely that some anchor firms might also be located in close proximity of each other, resulting in the issue that some firms are possibly in the sphere of influence of multiple anchor firms, another variable is included in the analysis indicating the extra distance to the second-closest anchor firm, in order to correct for this issue.

Secondly, in order to answer the third sub question, the firm employment growth rate of the related (closest) anchor firm is included as explanatory variable as this is needed to complement the dependent variable of the firm employment growth rate of the individual firms.

Finally, the sector in which the individual firms are operating is included as an explanatory variable as these might also explain the firm employment growth rates on the one hand and the likelihood that the anchor firm and related firm are operating in the same sector on the other hand.

3.4.3 Control variables

Although the variables discussed below are used to explain the spatial extent of externalities of anchor firms, there are also other locational factors that influence the business location

decision of firms. These factors are included as variables in this analysis to control for the effects of these factors in order to make sure the effects of the anchor firm are measured correctly. In the section below each control variable in either regression will be briefly described.

Included in the rare-event binary logistic regression (same sector)

Next to the explanatory variables of the distance to the closest and second closest anchor firm, the following control variables are included in rare-event binary logistic regression assessing the likelihood whether firms close to an anchor firms are more likely to be operating in the same sector.

Institutional variables: A variable is included to indicate the province in which the firm is located in since; these governmental bodies may have certain enabling of constraining rules in effect that makes a firm being either located or not located in these respective municipalities and/or provinces.

Sectoral variable: A variable indicating the sector the firm is operating in, based on the SBI-08 2-digit classification by the Central Bureau for Statistics (CBS, 2018). As the sector of the firm influences whether is likely to be important or not to be located close to an anchor firm in the same sector.

Firm size: A variable indicating the firm size in terms of the number of employees based on the LISA-dataset. This variable is included as the firm size is likely to be important in relation to the likelihood of the firm and the closest anchor firm operating in the same sector, therefore it is needed to control for this effect.

Urbanity: In order to correct for density, the degree of urbanity (Dutch: stedelijkheidsklassen) will be added to the regression, as this is likely to influence the likelihood of a firm operating in the same sector as the closest anchor firm, as in denser areas more firms will be around.

Included in the OLS regression (Firm employment growth rate)

Firm size: A variable indicating the firm size in terms of the number of employees based on the LISA-dataset. This variable is included as the firm size is likely to be important in relation to the firm employment growth rates, therefore it is needed to control for this effect.

Sectoral variable: A variable indicating the sector the firm is operating in, based on the SBI-08 2-digit classification by the Central Bureau for Statistics (CBS, 2018). As the sector of the firm influences the overall growth rate of a firm, certain growth-rates are more common among certain sectors, therefore it is included to control for this effect.

Economic growth rate / Population growth rate: To assess the market potential of a (new) firm it is important to include the economic growth over past years (MacCarthy, 2003). In addition, the development concerning the population growth or decline is of interest in relation to the market potential of the respective firms. Therefore, the average economic- and population growth rates between 2008-2016 are included in the analysis.

Access to labor: Firms, especially those with labor-intensive activities, are in need for labor in order to produce. Therefore, it is important that there is a sufficient labor pool in the vicinity (commuting distance) of the firm (MacCarthy, 2003). Measured as the potential labor force, including all persons between the age of 15 and 65, living in the postal code area.

Access to skilled labor: More importantly, this labor pool also needs to be skilled and suitable to the jobs provided by these firms (Salvesen & Renski, 2003). Therefore, the municipal percentage of higher-educated persons is included in the analysis, operationalized as the percentage of people who attained a HBO (University of Applied Sciences) degree or higher.

Firm activity: Apart from the anchor firm, firms can also derive externalities from being located close to (a substantial number of) other firms (Badri et al., 1994). This factor is measured by the number of firms per km² in the postal code area of the respective firm.

Urbanity: Also, firms can benefit from being located in an urban environment in order to benefit from urbanization economies. Therefore, the degree of urbanity is included based on the number of addresses in a 1km range of the respective firm.

Income per capita: The average income per capita per postcode area in which the respective firm is located is included in the analysis as this indicates the spending power of their most direct costumers (MacCarthy, 2003) in terms of businesses that are targeted towards consumers rather than firms as their customers.

Local taxes: As most firms are looking to maximize their profit, taxes are of major importance. The most important tax regarding firms in the Netherlands that is determined at the local level and therefore differs locally is the property tax (OZB), in some municipalities this tax can be 5 times as high as other municipalities and therefore worth taking into consideration when (re) locating a firm, especially if the firm relies on big or multiple buildings (Badri et al., 1994). Therefore, the property tax per municipality is included as control variable.

Other distance variables: The distance to the anchor firm is not the only distance variable that might explain firm location. Therefore, the distance to the most nearby highway ramp, indicating accessibility by car/truck, is included, also the distance to the most nearby train station and airport are included to indicate the accessibility by train and plane. Finally, the distance to University, University of Applied Science and vocational colleges are included as firms might benefit from cooperation with these educational institutions along with influx of new workers graduating from these schools.

Quality of life indicators: A factor that cannot be ignored, according to Salvesen and Renski (2003) is a set of indicators regarding the quality of life in the area near the firm. Therefore, three indices are included based on the cumulative distance to basic services (GP practice, Hospital, elementary school, secondary education, daycare), based on the cumulative distance to retail facilities (supermarket, department store, café, restaurant and hotel) and based on the cumulative distance to recreational services (library, music venues, amusement park, swimming pool, ice-skating rink, cinema and sauna). These indices are constructed based on CBS data (2016) and summarized in table 3 on the next page

Basic Services Index
Cumulative distance to closest:
GP Practice
Hospital
Elementary education
Secondary education
Daycare

Retail Services Index
Cumulative distance to closest:
Supermarket
Department Store
Café
Restaurant
Hotel

Recreational Services Index
Cumulative distance to closest:
Library
Music Venues
Amusement Park
Swimming Pool
Ice-skating Rink
Cinema
Sauna

Table 3: Quality of life indices (based on CBS, 2016)

3.5 Data requirements and preparations

In this section the requirements of the data as input for the analysis are discussed along with the preparations made to the data in order to prepare it for the analysis.

3.5.1 Distance variables

There are different types of variables of importance in this analysis. One of these types is based on the distance between firms and other points of interest, the most important being the distance between firms and the most nearby anchor firm. The LISA-dataset provides us with XY-coordinates of all firms throughout the Netherlands, which serve as an input to a GIS (Geographical Information System) analysis in order to derive these distance variables.

Since, the agents of firms are bound to the road infrastructure, the network distance will be used in the analysis instead of Euclidean distance in order to better represent this real-world phenomenon. First, the dataset is split between anchor firms and other firms based on the differentiation made in the section on operationalization. Secondly, a network dataset is created based on the National Road Database (NWB), after which a closest-facility analysis is run. This analysis calculates for each point (firm in this context), which anchor firm is closest based on network distance, resulting in a 'distance to anchor firm variable'.

This analysis is rerun multiple times in order to calculate the distance to the second closest anchor firm, distance to the closest highway and other points of interest discussed in the previous section.

3.5.2 Location variables

Another type of variable deals with the local characteristics of the location of a firm. Most of these characteristics are derived from datasets available at certain geographical units, for example a postcode area or a municipality. In order to connect this data to the specific firms a spatial join is carried out using GIS, this tool connects the data of a geographical unit with the data of a point feature (firm) located within the boundaries of this geographical unit.

3.5.3 Other preparations

Finally, when the dataset is completed after the previously discussed preparations are finalized, some additional preparations have to be made to prepare the dataset for the actual statistical analysis using STATA. This mainly has to deal with the sectoral part of the analysis. As previously mentioned, a dependent variable indicating whether a firm is operating in the same sector as the anchor firm needs to be generated based on the respective sectors of the anchor firms and other firms, resulting in a binary variable whether these firms are operating in the same sector or not. In addition, concerning the final sub question of this research, eventually the data needs to be split based on the firms being either not knowledge-intensive and knowledge-intensive as previously mentioned in the section on operationalization.

3.6 Reliability and validity

In conclusion, it is important to discuss the reliability and validity of the results that will be generated based on this methodology. Especially, since a model has been constructed in order to represent a real-world phenomenon. How does this model reflect this phenomenon? This will be the focus in the section along with the operational issues, the representativeness and the geographical demarcation of the research.

3.6.1 Model compared to real-world phenomenon

Ideally, a model should be a perfect representative of a real-world phenomenon, however this is nearly impossible in the social sciences. The aim is therefore, to approach reality. In this light, it is fair to discuss the shortcomings of the model used in the research beforehand and reflect on what it might implicate for the results.

First, as already touched upon, the definition of the anchor firm remains arbitrary, since it is solely based on the number of employees the firm has, while there are less quantifiable aspects to a firm being an anchor firm, most notably having a focus on research and development as defined by Agrawal & Cockburn (2003). Through k-means clustering a cut-off point was determined along with two additional cut-off points to test the robustness of this operationalization of an anchor firm. However, despite these measures it cannot be guaranteed that some firms might be denoted as anchor firms while they are not and vice versa, anchor firms are not denoted as anchor firms while they actually are.

In addition, the spatial extent of anchor firm externalities will be derived in two ways, based on the sector the respective firms are operating in and the annual firm employment growth rates of the (anchor) firm. The spatial extent of these anchor firm externalities is operationalized as either being operating in the same sector and experiencing similar annual firm employment growth rates. Considering the hypothesis that firms closer to the anchor firm are more likely to be operating in the same sector and the hypothesis that firms closer to the anchor firm are more likely to experience similar annual firm employment growth rates, this operationalization seems logical. However, this operationalization is not flawless, the location of a firm is not determined based on perfect information considering all factors including distance to an anchor firm and/or other points of interest. The point is that a firm

might be located relatively close to an anchor firm, might be even active in the same sector or experiencing similar growth rates, however little externalities spillover to this firm, this phenomenon might be especially true for urban areas as (firm)density might distort this operationalization. However, to include these factors as control variables this distortion might be minimized.

Another point of concern is the measurement of distance, as can be read in a previous section, network distance was planned to be used in this analysis. However, with approximately 1,8 million firms (that were present in the dataset at least twice between 2008-2016) and 3000 to 5000 anchor firms depending on the cut-off points, the computers were unable to process the closest facility network analysis needed to determine the network distance from the firm to the nearest anchor firm. After consultation with the Geodienst, the office for geo-information of the University of Groningen, it is decided to pursue the analysis using Euclidean (as-the-crow-flies) distance. Considering the dense road network in the Netherlands along with previous research confirming high correlations between Euclidean and network distances (Roquette et al., 2013; Apparicio et al., 2008; Higgs et al., 2012) this is not likely to distort the results too much. However, it cannot be ignored that in some cases the closest anchor firm based on Euclidean distance turned out to be another anchor firm than if it were based on network distance, additionally, the extra distance to the second nearest anchor firm is also included in the analysis.

3.6.2 Representativeness

In terms of representativeness, there are little issues. The LISA dataset encompasses all firms located in the Netherlands, therefore all firms having at least two entries in the dataset between 2008 and 2016 are included in the analysis, as it was needed to calculate firm employment growth rates for these firms. This resulted in the fact that firms only present in the dataset for one year were excluded unfortunately, while these firms could have had an impact on the (anchor) firm dynamics in their respective regions although it was only for a limited amount of time. Same applies for firms that never entered the dataset since they only existed between two reference dates.

3.6.3 Geographical demarcation

The firm locations included in this analysis are derived from the LISA dataset, as previously mentioned this only includes business-locations within the Netherlands. This raises two questions concerning the geographical demarcation of this research. First, the Netherlands is part of the European Union and its common market. This guarantees the free movement of goods, capital, services and labor within the European Union (European Commission, 2018). This implicates that a firm located in the Netherlands can benefit from externalities from an anchor firm (just) across the border in either Germany or Belgium or vice versa a Dutch anchor firm spreading its externalities towards firms in these respective countries. Unfortunately, this cannot be accounted for in this research, however cross-border cooperation between (anchor) firms should not be overestimated. Although some institutional boundaries might have decreased through EU regulations, certain (cultural) boundaries remain present and withhold firms (and people working at those firms) from cooperating (Van Houtum, 1999).

Secondly, although the anchor firm phenomenon is assessed at a large geographical scale, an entire country, one should reflect on the generalizability of this research as it is solely focused on the Netherlands. The Netherlands is very densely populated, which also applies to its firms. Indicating that possible distance effects found in the analysis might be larger or smaller compared to other countries like the United States, Great Britain or Germany. Therefore, caution should be advised when taking these results in the context of another country.

4. Results

In the following section the results of this research will be presented and reflected upon, making use of the previously constructed theoretical framework.

4.1 The distribution of anchor firms: an overview

This section functions as an introduction to the main core of the results. The descriptive statistics of the dataset as a whole, along with the main variables are briefly discussed and put in context of academic literature and the following analysis. But first, the first sub question is answered: *''what is the spatial and sectoral distribution of anchor firms in the Netherlands?''*

4.1.1 Sectoral distribution of anchor firms

In the methodology section (section 3.1), a brief overview has already been given on the number of anchor firms per sector for all samples including the respective percentages. It taught us that three sectors (Manufacturing, Public Administration and Healthcare) alone are responsible for 53% (!) of all anchor firms. While in other sectors (for example: domestic services, real estate) there are virtually no anchor firms in this very sample. This raises the question what makes these three sectors so different in terms of being heavily overrepresented in the Anchor firm sample?

Manufacturing is historically a labor-intensive industry, but transformed into a capital-intensive industry, often involving large machines and other equipment, which are often expensive. Therefore, economies of scale play a large part is an industry like manufacturing, leading to the fact that firms in the manufacturing industry are often large also in terms of employees as still people are needed to operate, control and maintain these machines, as robotization does not necessarily lead to unemployment but rather changes employment (Graetz & Michaels, 2017). The healthcare industry is an industry that is human-based, either the direct care of people or developing means to improve the health of people. Either way firms in this sector therefore tend to have larger amounts of employees, and therefore many anchor firms (Spencer, 2013). Finally, public administration is a different industry, consisting of (semi-)governmental organizations, leading to a relative high amount of anchor firms as for example each middle-large municipality tend to have about 250 employees meeting the anchor firm threshold.

As we are still dealing with absolute numbers, it is important to compare these high percentages of Anchor firms in these particular sectors to the overall number of firms in these sectors. For example, there are 910 Anchor firms operating in the healthcare sector (248 sample) across 167.000 healthcare firms in general. When comparing this to the Consultancy, Research & Business sector with only 233 anchor firms over 370.000 firms overall. It can be concluded that anchor firms are a more common phenomenon in some sectors compared to other sectors. This also means, as anchor firms are more or less common in various sectors that the importance of being located close to an anchor firms either decreases or increases from sector to sector, as they are more/less common across space.

In addition, there is a size-effect present as the relative distribution of anchor firms between sectors shifts across the different samples, which are defined by the firm sizes. In some sectors

increasing the cut-off points leads to relatively less anchor firms present in that sector (for example: construction, retail and logistics), but in some cases the relative amount of anchor firms holds or increases along with the cut-off point (for example: Finance, Healthcare and Public Administration). Meaning that the firm-size distribution differs across sectors, indicating that the definition of an anchor firm (in terms of firm size) differs across sectors, which is important to take into account when assessing the further results.

Finally, this raises the question how these sectoral dynamics influence the spatial extent of the anchor firms' effects? From academic literature, in a North-American context, it is known that the proximity to anchor firms is more important to some sectors opposed to other sectors (Spencer, 2013). Firms in the auto-manufacturing industry for example, tended to be closer located to an anchor firm, since '*just-in-time delivery systems whereby inventories are kept to a minimum for maximum efficiency are in place, making shorter distances between suppliers and the anchor firm a more important consideration in firm location decisions'* (Spencer, 2013, p.14). On the other hand, firms in the food-manufacturing tend to be rather dispersed, not necessarily located in close proximity to an anchor firm, *'as food production generally conforms to classical notions of industrial geography whereby production is typically located near sites of resources or consumption'* (Spencer, 2013, p.10).

In section 4.4, a full synthesis is given on sectoral dynamics influencing the spatial extent of anchor firm externalities, including the results of both regression analyses in light of sectoral differences.

4.1.2 Spatial distribution of anchor firms

In addition, the spatial distribution of anchor firms cannot be ignored, the general distribution of anchor firms will be displayed through a point density map. In addition, a spatial-sectoral overview will be given to assess the spatial patterns of anchor firms across different sectors. Finally, the relative importance of Anchor firms to the regional economy will be highlighted by displaying the number of jobs of the anchor firms compared to the overall number of jobs in the COROP regions of the Netherlands.

On the following page in figure 4, the general spatial distribution of anchor firms in the Netherlands can be found based on the 248-sample meaning that all firms with over 248 employees are included into this sample, from which a couple of conclusions can be drawn. In order to avoid confusion, it is important to note that this map tells us about the spatial distribution of anchor firms throughout the Netherlands, not the relative presence of anchor firms compared to the presence of other 'regular' firms.

First, although the map in figure 4 does not show it directly, the spatial distribution of anchor firms is spread throughout the Netherlands, the lightest color of blue does not necessarily indicate that there are no anchor firms at all, in fact when analyzing the inputs for this point density map, being all the separate anchor firm locations, the entire Netherlands was covered by points marking anchor firm locations. This indicates that the prerequisites for an anchor firm to establish itself are not entirely tied to most favorable location in terms of quantitative and/or qualitative factors, but also rely on a certain path dependency including factors tied to the business itself, coincidence or even chance (Boschma & Lambooy, 1999).

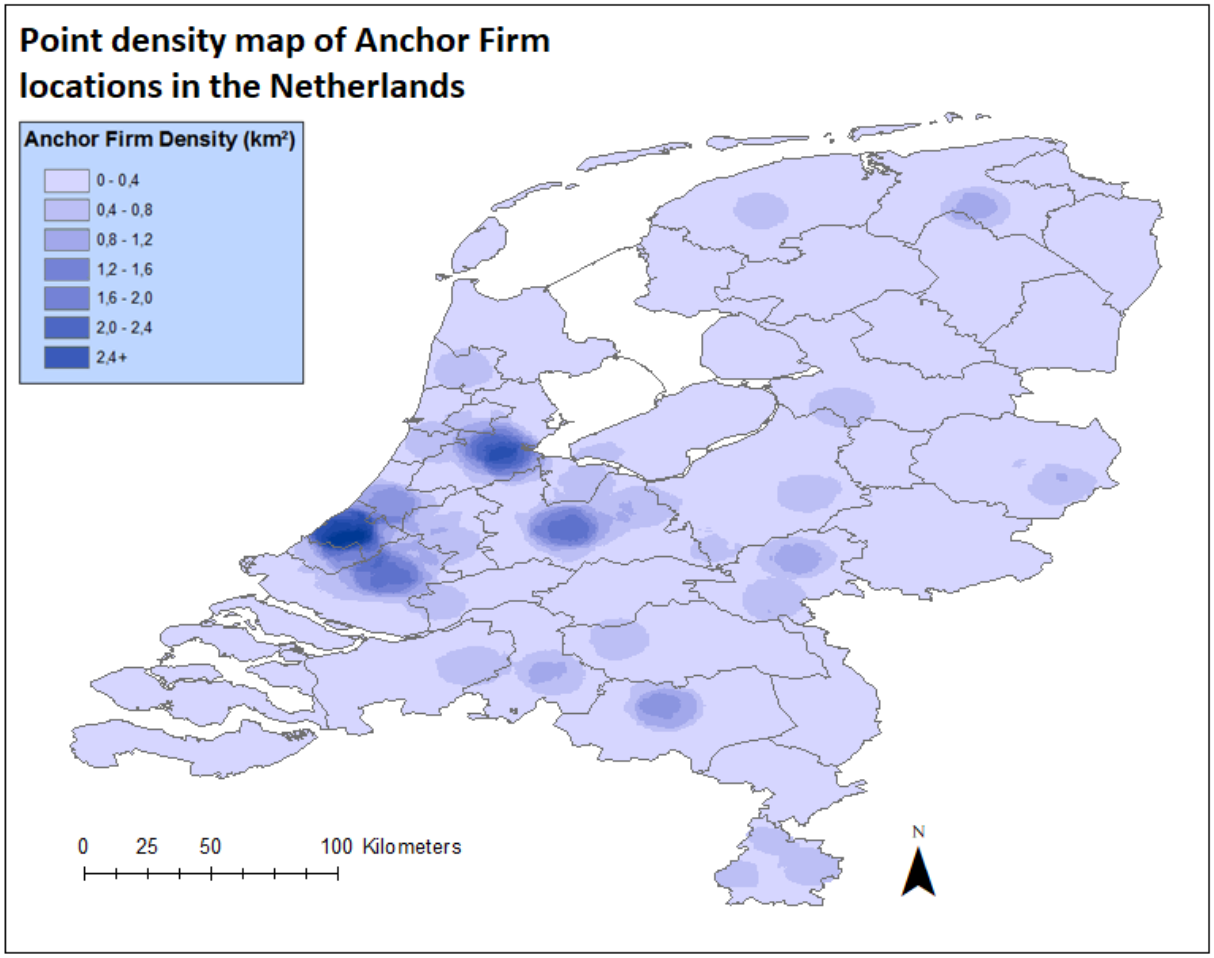

Figure 4: Point density map of Anchor firm locations in the Netherlands (based on LISA, 2016)

However, keeping in mind the overall spatial distribution being relatively spread, this adds strength to the fact that there are numerous concentrations of anchor firms in the Netherlands that cannot be ignored. In terms of concentrations of anchor firms, there can be two types of locations/places distinguished. First, the four big cities in the Randstad and their direct surroundings (Amsterdam, Rotterdam, The Hague and Utrecht). Secondly, numerous of regional centers, mostly medium-big cities in the Netherlands, such as Eindhoven, Groningen, Arnhem-Nijmegen, Twente and so on. As a side-category, as an honorable mention, there were also some surprises when analyzing this map, for example Alkmaar and Apeldoorn also seems to have a relatively high concentration of anchor firms, cities that are not necessarily known for being large regional economic centers.

Not surprisingly, the highest concentrations of anchor firms can be found in the Randstad area as just mentioned, there are basically two types of explanations for this clustering phenomenon in the context of this research.

First, urbanization economies, these can be regarded as the economies of scale external to any industry and resulting from the general level of the urban economy (Hoover, 1937). Anchor firms seem to profit from the diversity and scale of the urbanization economies of the Randstad area, as this is the main economic/urban core of the Netherlands, in which the scale

and diversity of urbanization economies are deemed to be most present and substantial compared to other regional economic centers across the Netherlands.

Another explanation for anchor firms to be located in urban areas is the presence of localization economies as well as the different types of proximities (Boschma, 2005) that play a part in this process of anchor firm location choices. Localization economies are benefits for a firm derived from the presence of other firms operating in the same industry in a particular place (Jofre-Monseny et al., 2012), consisting of three components: access to a skilled labour pool, the presence of specialized suppliers and knowledge spillovers through competing firms (Marshall, 1920). In urban areas, there is a bigger supply of skilled labour and firms, potential specialized suppliers, but most importantly in today's knowledge economy are the knowledge spillovers. As geographical proximity is smaller in urban areas, and although geographical proximity *'is neither a necessary nor a sufficient condition for learning to take place'* (Boschma, 2005, p.62). It can be a facilitator in the learning process, as a close geographical proximity can strengthen (bridge the gap between) the other dimensions of proximity (cognitive, organizational, social and institutional proximity) in order for innovation to occur.

Secondly, from an international perspective it can be explained why large firms, including anchor firms, are located in the main urban centers. As the world becomes more globalized, meaning that 'the cost of distance' has dropped significantly, in both transportation and communication, it suggests the death of distance (Cairncross, 1997) or the notion that the world is flat (Friedman, 2005). However, the contrary is true, as supply chains are globalized, face-to-face communication, transferring tacit-knowledge becomes more important (McCann, 2008). These face-to-face meetings often occur in the larger urban areas, the Randstad in the Dutch context, as these are well connected by a major airport hub and/or international train stations, therefore the world is not flat, but curved or even spiky, in which the largest urban centers, such as the Randstad, become more important for large (anchor) firms to locate opposed to other more regional urban centers. In addition, being located in a large urban area, such as the Randstad, is also beneficial as anchor firms can profit from the transfer of tacit knowledge locally (local buzz) as well as acquiring codified knowledge from global channels of communication (Global Pipelines), as is argued in the concept of 'local buzz, global pipelines' by Bathelt et al. (2003).

Another interesting question regarding the location patterns of anchor firms is the relation between the sector an anchor firm is operating in and its location. In figure 5 on the next page, the spatial sectoral distribution of anchor firms is shown in a map, by the sectoral distribution set against the COROP regions of the Netherlands. To improve the readability and understandability of this map, the sectors are grouped as can be seen in the legend of the figure 5.

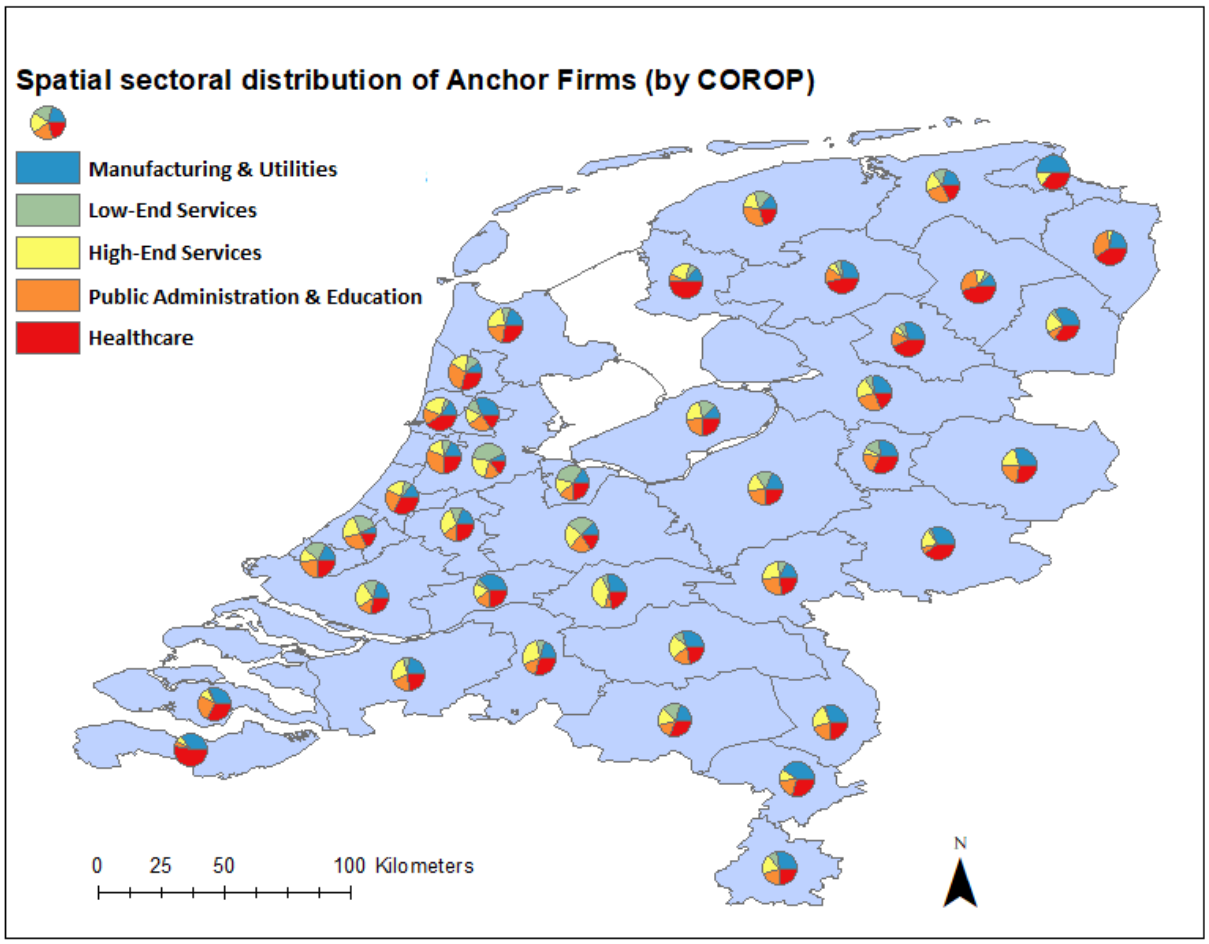

Figure 5: Spatial sectoral distribution of anchor firms by COROP region (based on LISA, 2016)

As can be seen from figure 5 there are differences in the sectoral distribution of anchor firms in the COROP-regions. In some regions, the manufacturing anchor firms are the vast majority, in which the manufacturing and utilities sector group represents over 25% to 50% of the total anchor firm population. These regions can be found along the eastern and southern border, in the relatively peripheral regions, which can be explained by the fact that firms in the manufacturing sector group are relatively big firms, a single entrepreneur cannot build a factory instantly, since often a lot of capital is required (Chen, 1999). Also, firms in the manufacturing industry often need space, which can be found at cheaper rates in these areas (Glaeser & Kerr, 2009) along with the fact that there are less anchor firms in the first place in these areas explains the fact that manufacturing anchor firms are overrepresented in these regions.

When it comes to the service industry, both low- and high-end services, a clearer pattern emerges. This seems to be bound to COROP-regions with an urban core, most notably Amsterdam, The Hague and Utrecht in which the anchor firms in the service sectors represent over half of the total anchor firm population, but also cities/COROPs like Groningen, Flevoland (Almere/Lelystad) and other COROP-regions in the Randstad. As operating in the service industry often requires *''frequent face-to-face meetings, building relationships that may stimulate innovation''*, these firms are largely concentrated in urban areas (Wiig Aslesen & Isaksen, 2007, p.321). As urban areas are providing favorable location conditions for these

service sector firms, *''in offering easy access to highly educated and specialized labour, and including many potentially important clients''*, like other (anchor) firms and institutions (Wiig Aslesen & Isaksen, 2007, p.322).

Anchor 'firms' in public administration and education are quite evenly distributed in most COROP-regions ranging from a couple of percent to a little over 25% in some areas, not surprisingly in The Hague and surrounding COROPs, where the national government is located. Also, in COROP-regions that house the provincial governments the sectors seem to be overrepresented in the anchor firm population along with the renowned University cities.

Finally, anchor firms in the healthcare sector, this pattern appears to be more diverse. In some COROP-regions, over half of the anchor firm population consists of anchor firms operating in the healthcare sector, while in other COROP-regions this is only about 15%. The only distinguishable pattern is the fact that the share of health-sector anchor firms in the population is smaller in urban areas, as there are numerous other anchor firms in these COROPs, whereas in the predominant rural COROPs the share is higher as there were not that many anchor firms initially.

Finally, what share of jobs do these anchor firms add to the regional economy? In figure 6 below the number of jobs by anchor firms (<248 employees) are compared to the total number of jobs in the specific COROP regions.

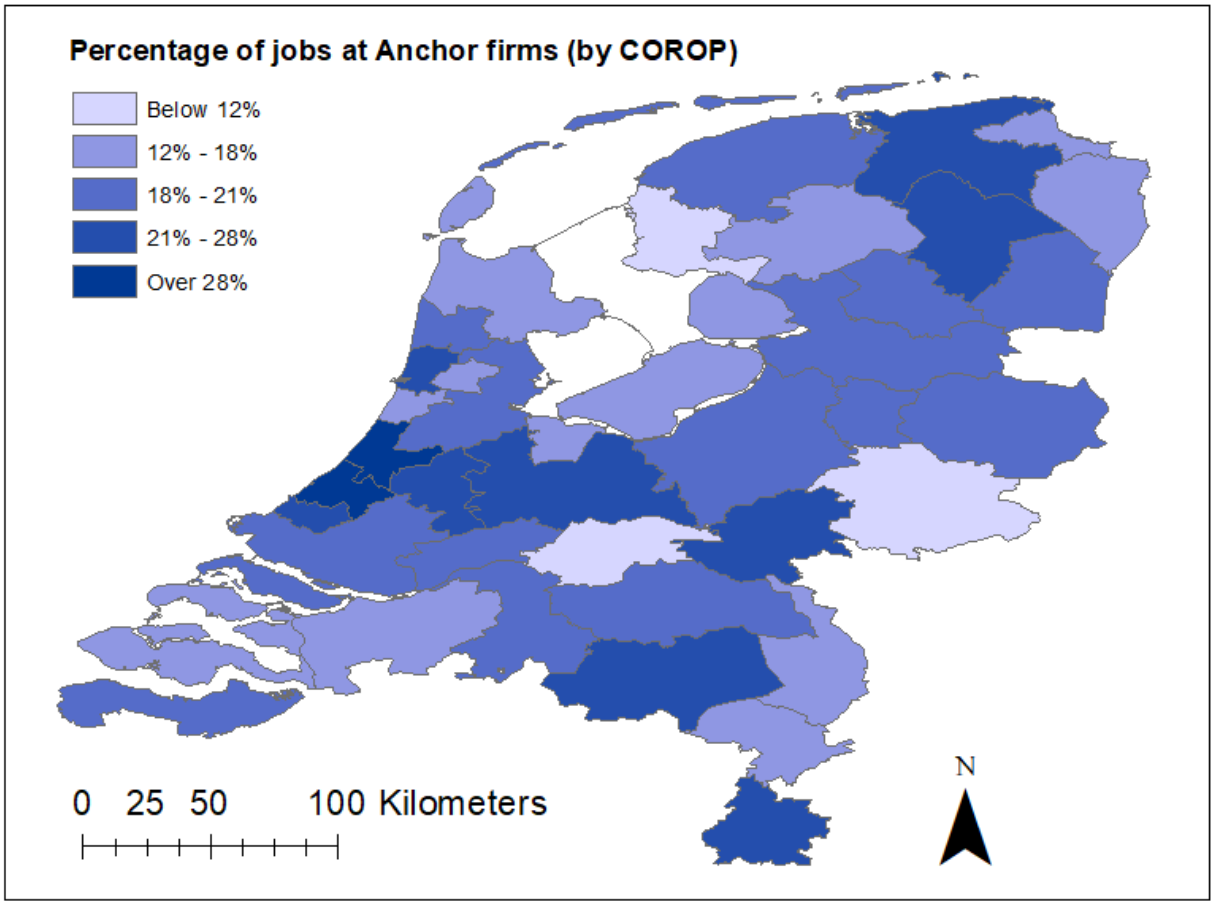

Figure 6: Percentage of jobs at anchor firms by COROP region (based on CBS, 2016; LISA, 2016)

It turns out that the percentage of jobs directly tied to the anchors firms, being firms with over 248 employees, is relatively substantial in most COROP-regions, averaging just under 20% of the total employment. However, there are some regional differences, ranging from under 12% to over 28%. The highest percentages can either be tied to the overall concentration of anchor firms in these regions, often urban areas as previously discussed and/or tied to a single (or some) very large employer(s) in that specific COROP-region. The most significant example in this respect is the COROP-region of IJmond, featuring the TATA Steel industry in IJmuiden. Other examples would be Philips in Eindhoven, the UMCG in Groningen and VDL Nedcar in Southern-Limburg.

On the other hand, the regions least reliant on anchor firms in terms of the percentage of total jobs appear to be more peripheral, as can be seen in figure 6. For example, Eastern-Groningen, the Achterhoek, Northern-Limburg and Zeeland and around the Ijsselmeer. Southwestern-Gelderland would be an exception to this pattern.

4.1.3 Descriptive statistics:

In this section the descriptive statistics of all variables are briefly discussed, in order to get familiar with the dataset and the exact meaning of the variables. In this section, only the main sample is discussed, which has 248 employees as the cut-off point for determining the anchor firm status of a firm, the descriptive statistics of the additional samples (cut-off points 194 and 299) can be found in the appendix.

The average distance between a firm and the nearest anchor firm turned out to be 1509 meters, with a range of 0 (located at the same address) to almost 33 kilometers for the most remote firms of the Netherlands as can also be derived from table 3 on the next page. This rather short distance is in line with academic literature, as the distance decay of externalities is rather steep, especially when these are related to knowledge spillovers (Andersson et al., 2016). The extra distance to the second closest anchor firm turned out to be 567 meters, with a range from 0 (closest and second closest anchor firm are equally far away) and nearly 17 kilometers.

Distance variables in meters (m) - 248 sample	Mean	Std. Dev.	Min.	Max.
Distance to Anchor Firm	1509	2036	0	32849
Extra distance to 2nd Anchor firm	567	1223	0	16758
Distance to University (WO)	15366	15297	0	101189
Distance to University of Applied Sciences (HBO)	11698	11238	0	66823
Distance to Vocational college (MBO)	7940	8230	0	42922
Distance to international airport	28769	19426	0	92402
Distance to train station	4772	5603	400	59000
Distance to Highway	1828	1329	100	46300
Cumulative distance to basic services*	11240	7852	2200	96000
Cumulative distance to recreational services*	44962	28241	7900	267600
Cumulative distance to retail services*	7397	5019	900	48800

*Cumulative distance of various facilities, exact composition can be found in the methodology chapter

Table 3: Descriptive statistics of distance variables

The descriptive statistics of the other distance variables, summarized in table 3 above, require little explanation. The distances to the educational institutions differ from about 15 kilometers to a university and 8 kilometers to a vocational college as there are more of these institutions present in the Netherlands. Another noteworthy aspect is the average distance to a highway, which is only 1828 meters, indicating the relative importance of being located close to it, although it should not be forgotten that the Netherlands has one of the densest road-systems in the world meaning that a highway is always quite near. A final note on the range of the value of these distance variables, the range is rather big. Ranging in most cases from virtually nothing to 100 kilometers, indicating that even in a densely populated country as the Netherlands, there are still significant differences in the accessibility of firms to educational institutions, transport opportunities and other services.

Besides the distance variables, there are also other variables included related to the business location of these firms, summarized in table 4 on the next page. Starting off with the annual firm employment growth as this is one of our dependent variables in the regression analysis. The average annual firm employment growth is 1,88%, however the range of values along with the standard deviation is large. This is due to outliers on both sides of the spectrum. First, there are firms that perform relatively well, and had a good number of employees at their first entry in the dataset. However, at their final entry nearly 'lost' all employees. On the other hand, there are some firms that had virtually no employees (1) at their first entry and the firm started growing rapidly to big firm of more than 2000 employees at their final entry in the dataset resulting in the value-range present.

The descriptive statistics for the other variables in table 4 on the next page require little explanation. The average economic growth of the areas the firms are located in are with 2,01%, slightly higher than the average annual firm employment growth, while the average population growth of these areas is just 0,6%.

Other variables – 248 sample	Mean	Std. Dev.	Min.	Max.
Firm growth (yr)	1,88%	8,73%	-12,24%	30,49%
Economic growth (yr)	2,01%	1,25%	-3,46%	5,19%
Population growth (yr)	0,60%	0,63%	-0,94%	2,41%
Property tax rate	0,12%	0,04%	0,05%	0,25%
% Highly Educated	30,20%	8,70%	10%	51,40%
Labour population	5513	3295	6	19600
Urbanity	2193	2174	2	11343
Firm Density	618	1100	0	6697

Table 4: Descriptive statistics of non-distance related variables

Another important variable as it is one of the dependent variables in the regression analysis, is the indicator whether the closest anchor is operating in the same sector or not? This variable is included twice below in table 5, one based on the two-digit level, indicating the exact defined (sub) sector. And, one based on the one-digit level, indicating broader sectoral groups, as firms might also experience learning effects of related diversity (Jacobs, 1969). Concluding from the table 5 below, the probability of the closest anchor firm being operating in the same (2,65%) or similar sector (8,31%) is not that high, which might indicate that the presence of an anchor firm in the same or related sector is not a major location factor for firms. The question is however, whether it is a random effect, or does it relate to for example distance, which will be discussed in section 4.2.1. Finally, the firms operating in either a knowledge intensive activity or a non-knowledge intensive activity is rather nicely distributed almost cutting the sample in half, 43,88% (KIA) to 56,12% (Non-KIA).

Same sector (2-digit) – 248 sample	Freq.	Percent.
Yes	49498	2,65%
No	1816560	97,35%
Same sector (1-digit) – 248 sample	**Freq.**	**Percent.**
Yes	154984	8,31%
No	1711074	91,69%
Knowledge Intensive Activity – 248 sample	**Freq.**	**Percent.**
Yes	818770	43,88%
No	1047288	56,12%

Table 5: Descriptive statistics of dummy variables

Concluding this section, the descriptive statistics of the related anchor firm sample will be presented in table 6. Although this sample was only used to determine the anchor firm distances for the other firms, discussing the descriptive statistics could hold valuable information on the location choices of these firms compared to 'regular' firms, justifying the chosen cut-off points.

First, on average anchor firms are closer to educational institutions, transport opportunities and other services than the non-anchor firms are. Also, the maximum values are lower in all variables. Most notably is the distance to the highway variable which maximum decreased from roughly 46 kilometers to only 6 kilometers, meaning that all anchor firms (in the 248 sample) are within a 6 kilometer range from the closest highway ramp, indicating that

accessibility by road, but also by train/plane, is more important to anchor firms opposed to non-anchor firms.

Distance Variables (in meters) - 248 Anchor Firm Sample	Mean	Std. Dev.	Min.	Max.
Distance to University (WO)	13392	14756	0	93579
Distance to University of Applied Sciences (HBO)	9878	10839	0	64099
Distance to Vocational college (MBO)	6778	8245	0	40676
Distance to international airport	27467	19523	0	83653
Distance to train station	3527	4574	400	50700
Distance to highway	1750	837	200	6000
Cumulative distance to basic services*	8852	5771	2200	56200
Cumulative distance to recreational services*	38306	23719	8100	231400
Cumulative distance to retail services*	6202	3720	900	41300

Table 6: Descriptive statistics of distance variables – Anchor Firms

Secondly, assessing the non-distance variables in table 7 below, most variables show similar averages compared to the non-anchor firm averages except for the annual firm employment growth variable, which is considerably higher, 2,86% over 1,88%, again heavily influenced by outliers as previously discussed.

Other Variables - 248 Anchor Firm Sample	Mean	Std. Dev.	Min.	Max.
Firm growth (yr)	2,86%	8,43%	-10,87%	29,62%
Economic growth (yr)	1,93%	1,24%	-3,46%	5,19%
Population growth (yr)	0,69%	0,61%	-0,94%	2,41%
Property tax rate	0,13%	0,04%	0,05%	0,25%
% Highly Educated	31,46%	8,49%	10,50%	51,40%
Labor population	4960	3381	6	17360
Urbanity	2212	1676	9	11121
Firm Density	537	820	0,38	6697

Table 7: Descriptive statistics of non-distance related variables – Anchor Firms

4.2 The spatial extent of anchor firm externalities: sectoral structure

In this section, the results will be discussed in relation to the second sub question of this thesis: 'What is the spatial extent of positive externalities from the anchor firm in terms of the sectoral structure of related firms'. Put otherwise, according to our hypothesis: 'does the likelihood of a firm operating in the same sector as the anchor firms declines, as the distance between the firm and anchor firm increases?'

Which would indicate that firms chose to locate in the vicinity of anchor firms to a certain spatial extent, as positive externalities from these anchor firms are only present to that spatial extent, as firms from similar sectors profit from localization economies, such as the availability of a skilled labour pool, specialized suppliers and knowledge spillovers (Marshall, 1920). Moreover, as a close geographical proximity strengthens and/or bridges the gap between

other types of proximity (Boschma, 2005), in order for these localization economies to be fully utilized, leading to innovation in these sectors.

As explained in depth in the methodology section, this has been operationalized by a dummy-variable indicating whether the closest anchor firm to a specific firm was operating in the same sector or not, set against a distance variable in a rare-event logistic regression corrected for other variables related to firm location choices. This has resulted in the following findings:

4.2.1 Anchor firm externalities: a localized phenomenon

As stated earlier, the dependent variable in the rare-event logistic regression analysis is the dummy variable indicating whether a firm is operating in the same sector as the closest anchor firm. Since, this can be regarded as an indicator for the spatial extent of anchor firm externalities. Before assessing the results of the regression analysis, it is important to see the initial relationship between this variable and distance.

As can be seen from table 8 below, the likelihood of a firm operating in the same sector as the closest anchor firm is not that high in general, ranging from 3,56% to 1,77% of the cases, this also legitimizes the use of a rare-event logistic regression analysis over an ordinary logistic regression analysis.

Distance (in meters)	0-499	500-1499	1500-2999	3000-4999	5000-7499	7500-9999	10000+
% same sector as Anchor Firm	3,56	2,35	2,05	1,83	1,88	1,77	1,9

Table 8: Crosstable between distance from the anchor firm and 'same-sector dummy'

Table 8 also suggests a rather steep distance decay curve as the likelihood decreased rapidly from the '0-499m category' (3,56%) to the '500-1499m category' (2,35%), stabilizing even further to a level around 1,8% for anchor firms located even further away than 3000 meters and beyond. This already points to our hypothesis of a declining likelihood of firms operating in the same sector as the closest anchor firm, as the distance between the two increases.

In addition, the hypothesis can be confirmed with the results of the rare-event logistic regression analysis, as can be seen from table 9 on the next page.

Rare-event Logistic Regression				
		LR chi2 (34)	=	49263,04
		Prob > chi2	=	0,0000
		Pseudo R2	=	0,1078
Log Likelihood = -203864,6				
Same Sector Dummy	**OR**	**Std. Err.**	**z**	**P> [z]**
Distance dummy (ref: 10000m +)				
0-499m	1,6815***	0,1083	8,07	0,000
500-1499m	1,0772	0,0694	1,16	0,248
1500-2999m	1,0125	0,0660	0,19	0,849
3000-4999m	0,9450	0,0623	-0,85	0,395
5000-7499m	0,9768	0,0660	-0,35	0,728
7500-9999m	0,9239	0,0694	-1,05	0,292
Urbanity level (ref: Zeer sterk stedelijk)				
Sterk stedelijk	0,8747***	0,0117	-10,01	0,000
Matig stedelijk	0,8458***	0,0139	-10,2	0,000
Weinig stedelijk	0,8892***	0,0157	-6,65	0,000
Niet stedelijk	0,8496***	0,0229	-6,04	0,000
Sector dummies (2-digit)	Included			
Provincial dummies	Included			
Constant	0,0152***	0,0012	-53,96	0,000

**** Significant at the 99% level*

Table 9: Rare-event Logistic Regression results

First, the model as a whole is proven statistically significant as the P-value is <0,0000. Moreover, the overall model has a pseudo R2 of 0,1078, which in ordinary logistic regressions is considered as low. However, in rare-event logistic regressions along with the context of this research and this dependent variable in particular, this can be considered as quite reasonable.

In addition, the level of urbanity is statistically proven a determinant for the likelihood of firms operating in the same sector as the closest anchor firm, it appears that the likelihood that a firm is operating in the same sector as the closest anchor firm is highest in the most densely populated areas. The sectoral- and provincial dummies are not discussed in this section, as it will be discussed in more depth in section 4.4 and are therefore left out in table 9 in order to keep it comprehensible.

Finally, the distance variable as can be seen from table 9, shows a range of different odds ratios in relation to the fact of a firm operating in the same sector as the closest anchor firm. All odds ratios are compared and must be interpreted in relation to the reference category of

firms located over 10km from the closest anchor firm, as this serves as the baseline measurement (=1).

To start with the closest category of '0-499m', firms located within a 500-meter range are 1,68 times a likely to be operating in the same sector opposed to firms located further than 10 kilometers away (ref. category). This rapidly decreases to an odds-ratio of 1,08 for firms located between 500-1499 meters away from the closest anchor firm, before the likelihood decreases further to virtually 1, from the 1500-2999 meters category onwards, similar to or even slightly below the baseline measurement of firms located over 10 kilometers away from the closest anchor firm.

Graphically, the trajectory of the explained phenomenon is displayed in figure 7 below.

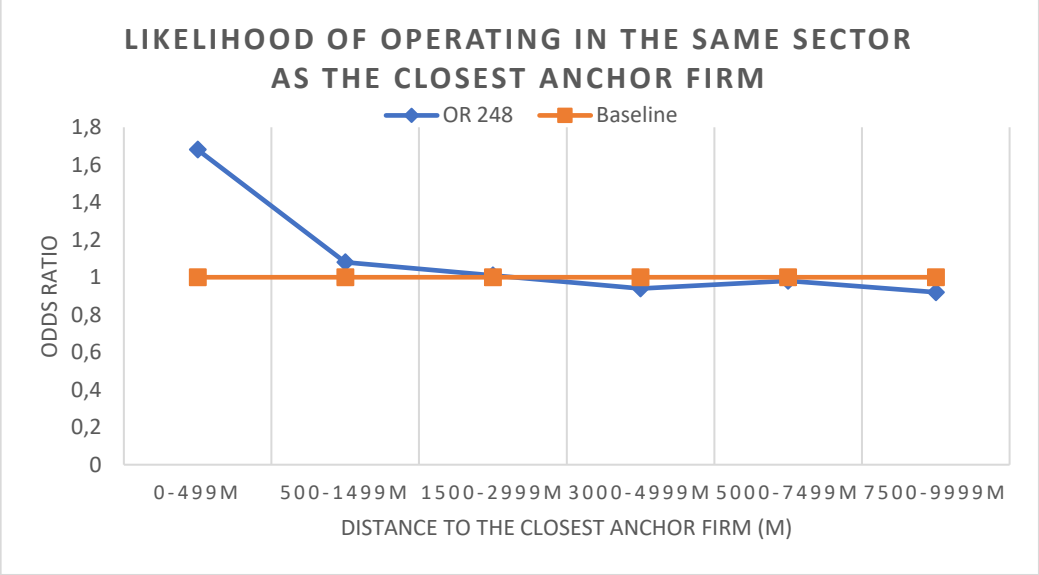

Figure 7: Likelihood of operating in the same sector as the closest anchor firm

When assessing figure 7 above, it becomes even more clear that the spatial extent of anchor firm externalities as operationalized as the likelihood of firms operating in the same sector as the closest anchor firm, is rather limited, to a spatial extent of no more than 3000m measured from the anchor firm location, with an even higher likelihood for firms located within 1500 meters. Although it should not be forgotten that the operationalization is rather limited as the likelihood of operating in the same sector as the closest anchor firm only indicates the extent of anchor firm externalities rather than proofing them, additional reflection on this point can be found in the discussion section (section 5.3).

Therefore, it can be argued that the anchor firm externalities are very localized confirming the hypothesis and given the theories on localization economies discussed before this is not that surprising. As anchor firms serve as an agglomerative force, based on its externalities to its surroundings, it stimulates the formation of new firms, possibly spin-offs (Klepper, 2001), economic growth and specialization of the cluster (Feldman, 2003). Specialization in this context means that the cluster of firms will become focused on the sector of the anchor firm, as it is most dominant. Firms will become specialized suppliers to the anchor firm, benefiting from the demand of the anchor firm. Moreover, firms also benefit from the skilled labor pool

that is present because of the presence of the anchor firm as well as the fact that firms have bigger opportunities to innovate as a result of the transfer of tacit knowledge derived from knowledge spillovers from the anchor firm (Feldman, 2003; Marshall, 1920).

Given all this, along with the notion that geographic proximity can overcome and bridge the gap between other types of proximity, that might prevent the optimal utilization of the localization economies (Boschma, 2005), it can be concluded that the results are in line with theory.

4.2.2 Does firm size matter?

In order to assess the robustness of the results, the analysis was carried out using three samples, which were all derived based on a different anchor firm size. In the section below, the results of these alternative samples will be reflected upon in relation to the main sample, answering two questions: do the results hold in the other samples (robustness) and is there some sort of size-effect? Do bigger anchor firms have a larger spatial extent of anchor firm externalities?

To start, both alternative models are proven statistically significant and show reasonable pseudo R2's of 0,104 (194 sample) and 0,117 (299 sample) in the context of the research and method. As can be seen from figure 8 below, the results of the alternative samples (OR 194/OR 299) are similar to the main sample (OR 248), figure 8 shows a similar course of the line having considerable higher likelihood of operating in the same sector as the closest anchor firm in the closest distance categories before the line smoothed to around the baseline level of firms located further away from the closest anchor firm than 10km. Therefore, it can be concluded that the results are robust. The corresponding tables can be found in the appendix, the corresponding regression outputs can be acquired by acquiring the author.

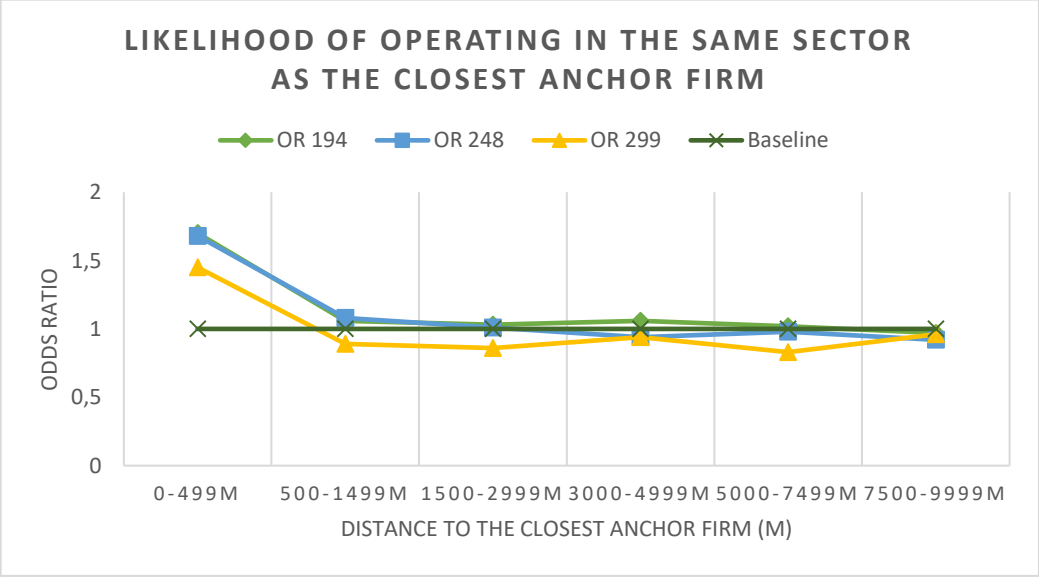

Figure 8: Likelihood of operating in the same sector as the closest anchor firm

However, the lines do not exactly match, is there a size-effect presence? Do bigger anchor firms have a larger spatial extent of anchor firm externalities? Based on these results you can even argue the opposite is true, as the sample based on the biggest anchor firms (OR 299)

shows the most localized effect, whereas the sample based on smallest anchor firms (OR 194) shows the largest spatial extent of anchor firm externalities based on this method. However, this is not the case, the model in this method, as used to predict this real-world phenomenon, is too limited in order to conclude this, as bigger anchor firms are more likely to be located in urban areas (Agrawal & Cockburn, 2003) the results still get distorted, although corrected for urbanity class, as in (denser) urban areas the likelihood of being operating in the same sector as the closest anchor firm is lower by default, therefore highlighting a flaw of the model.

4.3 The spatial extent of anchor firm externalities: firm employment growth

In this section, the results will be discussed in relation to the second sub question of this thesis: *'What is the spatial extent of positive externalities from the anchor firm in terms of firm employment growth of related firms?'* Put otherwise, according to our hypothesis: 'does the likelihood of a firm experiencing similar firm employment growth rates as the anchor firms declines, as the distance between the firm and anchor firm increases?'

Which would indicate that firms located more closely to anchor firms experience more similar firm employment growth rates as these firms benefit from the positive externalities of the anchor firms, especially based on the specialized supplier relationships along with the knowledge spillovers occurring between firms based on the shared skilled labour pool, labour mobility and spin-off dynamics (Draca et al., 2006; Klepper & Sleeper, 2005; Klepper, 2007). Resulting from the extensive sharing of knowledge through the mechanisms mentioned above, as well as the specialized supplier relationships between firms and anchor firms it can be expected that firms in closer geographical experience more similar firm employment growth rates opposed to firms located further away, which serves as an indicator for the spatial extent of these positive externalities derived from the anchor firm.

As explained in depth in the methodology section, this has been operationalized in a OLS regression in which the firm employment growth rate is taken as the dependent variable set against the distance variable corrected for other variables of interest, like the firm employment growth rates of the nearest anchor firms in order to draw the right conclusions in relation to the third sub-question. This has resulted in the following findings:

4.3.1 Anchor firms as a driving force for firm employment growth?

As firms can serve as specialized suppliers to anchor firms (Agrawal & Cockburn, 2003; Fritsch & Franke, 2004), as well as benefit from knowledge spillovers of the anchor firm through different mechanisms: spin-offs, exchange of personnel and interaction between personnel between anchor firms and other firms (Draca et al., 2006; Klepper & Sleeper, 2005). It can be expected that firms with a relation to the anchor firm experience similar employment growth rates as their performance is dependent to the performance of the anchor firm, this is a good indicator to assess the spatial extent of the anchor firm externalities in terms of employment growth: to what (spatial) extent does the firm employment growth rate of the anchor firm influence the firm employment growth rates of (nearby) firms? Put otherwise: what is the premium of being located close to an anchor firm in terms of firm employment growth?

First, the results of the OLS regression analysis as can be seen from table 10 below:

OLS Regression Analysis						
Source	SS	df	MS	F	=	2648,95
Model	6852406,1	108	63448,2	Prob > F	=	0,0000
Residual	42803302	1.787.028	23,9522	R2	=	0,1380
Total	49655708	1.787.137	27,7851	Adj. R2	=	0,1379
				Root MSE	=	4,8941

Firm Employment Growth	Coef.	Std. Err.	t	p > [t]
Distance to Anchor Firm	-0,0000742***	0,0000028	-26,30	0,000
Add. Distance to 2nd Anchor F.	-0,0000080***	0,0000030	-2,65	0,008
Firm Growth Anchor Firm 1	-0,0000086	0,0000073	-1,18	0,239
Firm Growth Anchor Firm 2	-0,0000016	0,0000044	-0,35	0,723
# Jobs Firm	-0,0010120***	0,0002584	-3,92	0,000
Economic Growth	0,0327596***	0,0037207	8,80	0,000
Population Growth	0,0559492***	0,0074452	7,51	0,000
% Highly Educated	-0,0012166	0,0006621	-1,84	0,066
# Labour population	-0,0000063***	0,0000013	-4,80	0,000
Adress density	-0,0000255***	0,0000051	-5,00	0,000
Firm density	0,0000539***	0,0000082	6,62	0,000
Municipal tax rate	-0,4063330***	0,1213299	-3,35	0,001
Distance to University	-0,0000013***	0,0000005	-2,73	0,006
Distance to HBO	-0,0000014***	0,0000005	-2,77	0,006
Distance to MBO	0,0000009	0,0000006	1,68	0,093
Distance to Int. Airport	0,0000022***	0,0000004	6,19	0,000
Distance to Trainstation	0,0000006	0,0000008	0,71	0,476
Distance to Highway	-0,0000003	0,0000027	-0,13	0,898
Basic services Index	0,0000034***	0,0000009	4,12	0,000
Recreational services Index	0,0000015***	0,0000003	5,13	0,000
Retail services Index	-0,0000021*	0,0703634	-2,01	0,045
Sectoral Dummies (2-digit)	Included			
Provincial Dummies	Included			
Constant	0,8904	0,0704	12,65	0,000

significant at the 95% level, * significant at the 99% level*

Table 10: OLS regression results

The model as a whole is proven statistically significant as the P-value is <0,0000. Moreover, the overall model has a R2 of 0,1380, which is not particularly high in OLS regression analysis. However, considering the context of the research and the dependent variable it is reasonable as firm employment growth is mostly influenced by individual choices and characteristics of firms, which unfortunately could not be all derived from the LISA dataset, as many of these factors are hardly quantifiable in the first place.

Zooming in on the main variable of interest, the distance to the anchor firm, the hypothesis of declining firm employment growth rates when the distance to the anchor firm increases, can be confirmed as it resulted in a negative coefficient of -0,0000742, which is proven statistically significant as $p < 0,05$ (<0,000). This indicates that with every meter a firm is located further away from the anchor firm, the firm employment growth rate decreased with 0,0000742%-point. Also, the presence of a 2nd anchor firm nearby is proven significant ($p = 0,008$), however the effect is substantially smaller as the firm employment growth rate only decreases with 0,000008%-point every additional meter a firm is located further away from the anchor firm.

The question remains however, how large the effect of anchor firm externalities is on the firm employment growth rate of nearby firms and to what spatial extent these effects last. By predicting, using averages for all other control variables, the effect is revealed. It showed, that a firm located at the same location as the anchor firm, for example in the same building (or address), has an additional firm employment growth of 1,006%-point, which can be ascribed to the anchor firm externalities. As this additional firm employment growth (the premium of being located close to an anchor firm) is decreasing with 0,0000742%-point every meter the firm is located further away from the anchor firm, it can be concluded that the spatial extent of this effect and thus the anchor firm externalities have a spatial extent of roughly 13,5km, the point at which the effect is equal to zero.

However, there are reasons to believe that the relation between distance from the anchor firm and the firm employment growth is non-linear. First, based on the results of section 4.2, which showed a non-linear almost classic distance decay relationship. As well as, the first law of geography by Tobler: *'everything is related to everything else, but near things are more related than distant things'*, known as the first law of geography (Tobler, 1970, p.237), as discussed in the theoretical framework. To be more precise a distance decay function of a relationship between firms involving distance can best be characterized as a negative exponential function in which interaction between firms is high over short distances, whereas interactions are rapidly (exponentially) decreasing as firms are located further away from each other (Nekola & White, 1999).

Therefore, the OLS regression was re-run using a categorical distance variable in order to assess the possible non-linearity of the phenomenon. The results of this alternative OLS regression analysis using a categorical distance variable can be seen from table 11 on the next page:

OLS Regression Analysis						
Source	SS	df	MS		F	= 2574,6
Model	6952198,6	113	61523,9		Prob > F	= 0,0000
Residual	42703509,3	1.787.024	23,896		R2	= 0,1400
Total	49655707,9	1.787.137	27,785		Adj. R2	= 0,1400
					Root MSE	= 4,8884

Firm Employment Growth	Coef.	Std. Err.	t	p > [t]
Distance dummy (ref: 10000m +)				
0-499m	0,4771233***	0,0472560	10,10	0,000
500-1499m	-0,1030118*	0,0467562	-2,20	0,028
1500-2999m	-0,2399949***	0,0467259	-5,14	0,000
3000-4999m	-0,2520779***	0,0467277	-5,39	0,000
5000-7499m	-0,2461078***	0,0468663	-5,25	0,000
7500-9999m	-0,1834327***	0,0510276	-3,59	0,000
Distance to 2nd Anchor Firm	-0,0000068**	0,0000030	-2,25	0,024
Firm Growth Anchor Firm 1	-0,0000086	0,0000073	-1,18	0,239
Firm Growth Anchor Firm 2	-0,0000016	0,0000044	-0,35	0,723
# Jobs Firm	-0,0011746***	0,0002589	-4,54	0,000
Economic Growth	0,0329593***	0,0037207	8,86	0,000
Population Growth	0,0519301***	0,0074594	6,96	0,000
% Highly Educated	-0,0014931**	0,0006616	-2,26	0,024
# Labour population	-0,0000053***	0,0000013	-4,02	0,000
Adress density	-0,0000305***	0,0000052	-5,89	0,000
Firm density	0,0000538***	0,0000082	6,55	0,000
Municipal tax rate	-0,4357532***	0,1214150	-3,59	0,000
Distance to University	-0,0000012**	0,0000005	-2,46	0,014
Distance to HBO	-0,0000016***	0,0000005	-3,14	0,002
Distance to MBO	0,0000009	0,0000006	1,55	0,122
Distance to Int. Airport	0,0000021***	0,0000004	5,86	0,000
Distance to Trainstation	0,0000002	0,0000008	0,28	0,780
Distance to Highway	-0,0000052	0,0000027	-1,93	0,054
Basic services Index	0,0000029***	0,0000008	3,59	0,000
Recreational services Index	0,0000015***	0,0000003	4,94	0,000
Retail services Index	-0,0000007	0,0000010	-0,64	0,522
Sectoral Dummies (2-digit)	Included			
Provincial Dummies	Included			
Constant	0,8582***	0,0838	10,24	0,000

significant at the 95% level, ** significant at the 97,5% level, * significant at the 99% level*

Table 11: OLS regression results

The model as a whole is proven statistically significant as the P-value is <0,0000. Moreover, the overall model has a R2 of 0,14, which is indeed slightly higher than the linear model

discussed before and given the context of the research and the dependent variable the R2 is reasonable.

Given the fit of the model is improved, how does this show in the relationship between distance from the anchor firm and the firm employment growth levels, as this serves as an indicator for anchor firm externalities. The dummies of the alternative distance variable are proven significant at least at the 95% level. Moreover, the individual coefficients of the distance dummies show a rather steep distance decay curve, with a considerable positive coefficient for the closest distance category (0-499m: 0,477), whereas the other distance categories even show slightly negative coefficients.

In order to assess this relationship in more depth, the regression equation is filled in with the averages of the control variables, these results are shown graphically below in figure 9.

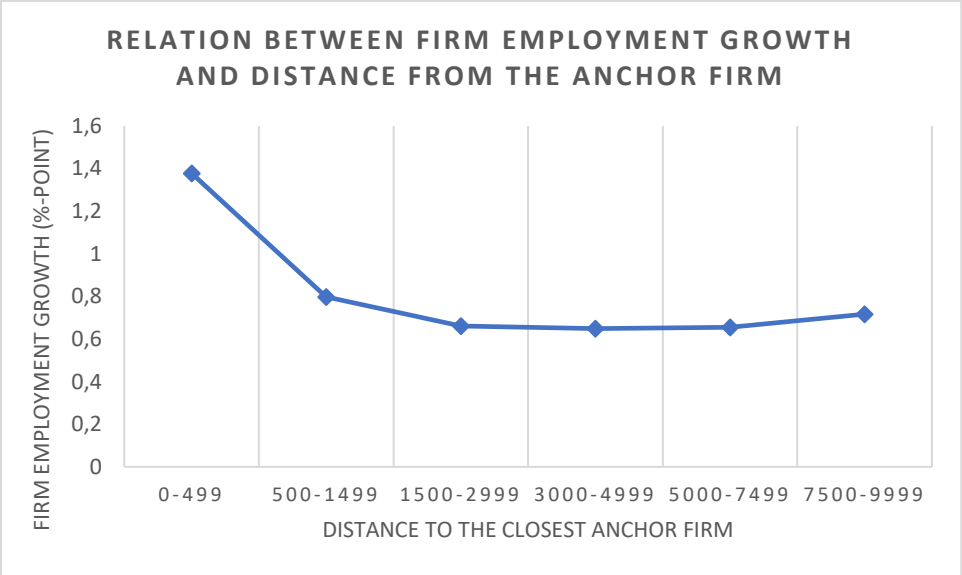

Figure 9: Relation between firm employment growth and distance from the anchor firm

Firstly, the relationship seems rather similar to the relationship found in section 4.2 concerning the likelihood of a firm operating in the same sector as the closest anchor firm. As being located close to an anchor firm (0-499m) results in 1,378%-point in additional firm employment growth, this rapidly decreases to 0,798%-point for firms located between 500-1499 from the closest anchor firm, before stabilizing even further to a level around 0,65%-point. As the predicted variable is firm employment growth, and only 14% of the model is explained by the (control) variables included in the model as previously discussed, it can be argued that the base level of firm employment growth influenced by factors not included in the model lies around 0,65%-point, at the point at which the predicted relationship stabilizes.

Concluding, using both OLS regression analyses, it became clear that the effect of anchor firms in terms of additional firm employment growth has a spatial extent of about 13,5km, the point at which the effect reaches absolutely zero. However, based on the other regression analysis it became clear that the distance decay function of this effect is rather steep, as the effect stabilizes after maximum 3 kilometer, meaning that the effect is very minimal (virtually non-existent) after this point till an absolute maximum of 13,5 kilometer.

The localized nature of anchor firm externalities holds true also in terms of firm employment growth as a result of being located close to an anchor firm. As previously discussed, there appear to be two lines of explanations, in which these results can be explained. First, improved employment growth rates as firms serve as specialized suppliers to the anchor firm. Secondly, the transfer of knowledge spillovers (either through labor-mobility, spin-offs and/or face-to-face interaction) which can allow firms to innovate at a similar rate than the anchor firm resulting in similar employment growth patterns. In either line of explanation, the localized nature of the phenomenon can be explained.

First, if firms serve as a specialized supplier to an anchor firm, it makes sense for firms to be located close to anchor firms, as in the context of the Netherlands, a tertiary economy, the specialized supplier is probably supplying high-complexity products, which acquires a lot of information sharing, feedback on the product etc. (tacit knowledge), in order for this tacit knowledge to be transferred face-to-face meetings are essential (Boschma, 2005; Howells, 2002) and therefore it is beneficial for specialized suppliers to be located close the anchor firm as employees of either firm can meet up right away in case of an certain issue, as firm located in close geographic proximity are more likely to have face-to-face contacts, which can build trust between agents and lead to more personal and embedded relationships between firms (Boschma, 2005; Harrison, 1992).

The last argument already touched upon the second line of explanation, as the sharing of knowledge between firms and anchor firms happens between the 'agents' (employees) of either (anchor) firm (Boschma, 2005). As previously discussed knowledge in shared in the 'specialized supplier process', however there are multiple other mechanisms through which knowledge spillovers occur and why these are geographically bound to a localized spatial extent. First, labor mobility, employees switch jobs between the anchor firm and other firms or vice versa (Bird, 1996), as these employees have a certain knowledge base, they take that with them to their new employer, in combination with the knowledge already present at the firm, it can lead to 'new combinations' of certain bits of knowledge coming together leading to innovation in the process (Schumpeter, 1934). However, this does not necessarily explain the localized nature of the phenomenon. However, labor mobility does not stand at itself, as the employee probably has a house, a family, a social life at the place of his previous employer (the anchor firm), it is likely that employees transfer to jobs at firms nearby the anchor firm (Canzler, 2016), the job might even be offered from someone a person met during an informal face-to-face meeting, for example in a coffee-bar an employee goes to during lunch, meeting people from other nearby firms also on their lunch breaks.

Which brings us to the second source of localized firm employment growth around the anchor firm, as knowledge spillovers often occur in an informal setting, such as a meeting at the coffee-bar, employees meeting during sports, at the schools of their kids and so on (Jacobs, 1969; Ponds et al., 2009). All these activities happen locally around the anchor firm or the place of residency, which is likely to be also rather close to the anchor firm, especially in urban areas in which anchor firms tend to be located as is concluded in section 4.1.

Additionally, spin-offs from the anchor firm also explain the localized nature of firm employment growth derived from being located close to an anchor firm. As spin-off are

started by former employees of the anchor firm, these firms have a similar knowledge base (Klepper & Sleeper, 2005) and therefore are likely to be performing similar in terms of employment growth, ties to the anchor firm remain present and might even strengthen as over time the spin-off might become a specialized supplier to the anchor firm, or even becomes responsible for a certain part of the production (of knowledge) (Klepper, 2007). As the old and possibly new ties between the anchor firm and the spin-offs are undeniable along with similar arguments concerning the former employees having local ties (house, family…) spin-offs are likely to be located close to their 'parent' anchor firms.

Finally, urbanization economies cannot be denied in this context as these are probably present in the vicinity of the anchor firm, nearby firms can also profit from amenities/services that originally adhere to the presence of an anchor firm, for example the presence of a fiber-optic network for high-speed internet, security and the availability of third party services. Which might allow firms to hire extra personnel, as they do not or only partially have to deal with those costs, explaining higher firm employment growth rates nearby anchor firms opposed to areas further away.

4.3.2 Does firm size matter?

In order to assess the robustness of the results, the analysis was carried out using three samples, which were all derived based on a different anchor firm size. In the section below the results of these alternative samples will be reflected upon in relation to the main sample, answering two questions: do the results hold true in the other samples (robustness) and is there some sort of size effect present? Do bigger anchor firms have a larger spatial extent of anchor firm externalities?

To start, both alternative models are proven statistically significant and show reasonable R2's of 0,1467 (194 sample) and 0,1306 (299 sample) in the context of the research and method. Also, both models show a negative (declining) relationship between firm employment growth and distance to the closest anchor firms, however there are differences in the rate of this decline, as the results from the 194 sample show a decline rate of 0,0001033%-point per meter on a 'base-premium' of being located close to an anchor firm of 0,86%-point (predicted as if a firm is located on the same address as the anchor firm, distance = 0), meaning that the externalities of smaller anchor firms (194 sample) have only a maximum spatial extent of about 8,5km (the point at which the effect is absolutely 0). Whereas, the externalities of larger anchor firms (299 sample) is 17km, with a 'base-premium' of 0,93%-point and a decline-rate of 0,0000548%-point per meter located further away from the closest anchor firm.

However, since it is proven that the relationship between firm-employment growth and distance to the closest anchor firm is non-linear, the alternative samples were also analyzed using categorical distance variables in the OLS regression. Which again resulted in improved R2's for both models, 0,1488 and 0,1325 respectively and overall significance of the model at $P < 0,000$.

In order to assess this relationship in more depth, the regression equation is filled in with the averages of the control variables, these results are shown graphically below in figure 10. The

corresponding tables can be found in the appendix, the corresponding regression outputs can be acquired by acquiring the author.

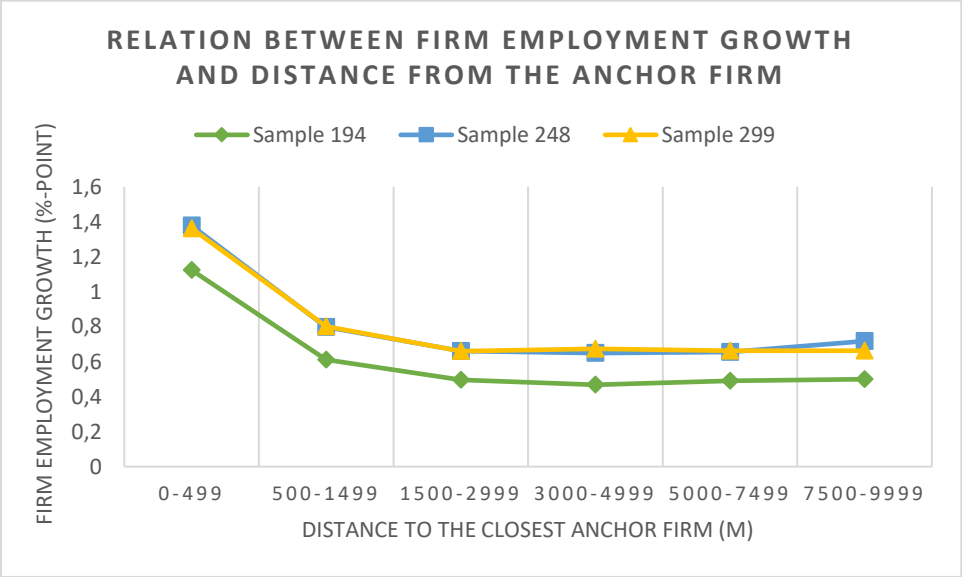

Figure 10: Relation between firm employment growth and distance from the anchor firm

Firstly, the relationships seem rather similar to the relationship previously found in this section, especially the larger anchor firm sample (299 sample) is almost identical, as being located close to an anchor firm (0-499m) results around 1,3%-point in additional firm employment growth, this rapidly decreases around 0,7%-point for firms located between 500-1499 from the closest anchor firm, before stabilizing even further to a level around 0,6%-point.

Although the sample consisting of the somewhat smaller anchor firms show the same trajectory, the line is substantially lower compared to the other two samples. Therefore, in terms of robustness it can be concluded that the results show a high degree of similarity meaning that the results can be considered robust. In terms of a possible size-effect, it can be concluded that especially the smaller anchor firms have a slightly more limited effect and spatial extent of their externalities.

So, what explains this smaller effect and spatial extent for smaller anchor firms? First, as most externalities are either directly or indirectly derived from face-to-face interactions between the employees of the anchor firm and employees from other firms (Boschma, 2005; Howells, 2002), it can be concluded that given the fact that these smaller anchor firm have less employees to interact with, the quantity of this face-to-face interaction is lower, meaning there are lesser knowledge spillovers occurring between the (agents of) anchor firm and other nearby firms. However, we should also reflect on the operationalization of the anchor firm in this context, as the 194 sample, which is based on distance to the closest (anchor) firm of over 194 employees, might be distorted as firms might have been labelled as an anchor firm by this definition, while they are actually not, as the actual definition of an anchor firm reaches further than just a number of employees. According to the definition, it should also have substantial roots in the local economy as well as some orientation towards R&D (Agrawal & Cockburn, 2003). So, it could be the case that a firm has over 194 employees, while their operations are very labor-intensive, but the firm has limited ties to the regional economy and

no R&D operations, meaning that it should not be regarded as an anchor firm according to the full definition by Agrawal & Cockburn (2003), while in our operationalization it is unfortunately included, distorting the samples, especially the 194 sample as the employee threshold is simply lowest. This also legitimizes the robustness test, as well as the choice for the 248-employee threshold for the main sample, however it also questions the smaller effect and spatial extent of externalities of smaller anchor firms.

4.4 Sectoral differences in the spatial extent of anchor firm externalities

In this section, the results will be discussed in relation to the second sub question of this thesis: *'What are the sectoral differences in the spatial extents of the labor market- and sector effects?'* Put otherwise, according to our hypothesis: 'There is sectoral variation in the spatial extent of externalities from the anchor firms, but the spatial extent is smaller for knowledge-intensive sectors as opposed to non-knowledge intensive sectors'

This assumes that firms from different sectors rely differently on the various components localization economies, as they are more or less reliant on one or more of the components, for example some sectors might be more reliant on the skilled labour pool, whereas other sectors are more reliant on specialized supplier relationships and/or knowledge spillovers. Along with the fact that these types of externalities seem to have differing spatial extents (Andersson et al., 2016; Malmberg & Maskell, 2002; Anselin et al., 2000; Spencer, 2013), it seems clear that the spatial extent of anchor firm externalities are differing from one sector to another. In general, it is expected that knowledge-intensive sectors have a smaller spatial extent of anchor firm externalities as these are primarily reliant on knowledge spillovers, which transfer over short distances (Andersson et al. 2017; Malmberg & Maskell, 2002), whereas in the non-knowledge-intensive sectors there is more emphasis on the skilled labour pool and specialized supplier effects, which are also present at longer distances (Anselin et al., 2000; Spencer, 2013).

In terms of methodology, the same procedure was followed as in section 4.2.1 and 4.3.1, however differentiated based on five sector-groupings (Manufacturing & Utilities, Low-end services, High-end services, Public administration & Education and Healthcare) and a differentiation between knowledge-intensive and non-knowledge-intensive firms.

While the results follow the same analogy compared to the results of sections 4.2.1 and 4.3.1, the results are discussed in a more compact graphical manner in order to keep the whole comprehensible as it deals with many sub-samples of the different sector-groupings.

4.4.1 Knowledge-intensive vs. non-knowledge intensive: different dynamics

As knowledge spillovers tend to be localized to a small spatial extent (Andersson et al., 2016), it would not be surprising that the spatial extent of anchor firm externalities of knowledge-intensive firms is more limited opposed to non-knowledge intensive firms, based on the 'knowledge intensive activity' (KIA) distinction made by Eurostat (2018), in which a third of the total employment in these sectors is tertiary educated.

As can be seen from figure 11 below, our hypothesis that there are different dynamics between firms operating in knowledge-intensive activities opposed to firms not operating in knowledge-intensive sectors is confirmed. Although both samples do show a considerable higher likelihood of operating in the same sector as the anchor firm until 1,5km compared to the baseline average of firms being located further away than 10 kilometers from the closest anchor firm, indicating benefits for firms to be located close the anchor firm. However, after this initial similar peak the dynamics seem to change as the likelihood of knowledge-intensive firms declines even further, even under the baseline average, whereas the likelihood of non-knowledge intensive firms barely decreased further and lingers even above the baseline average.

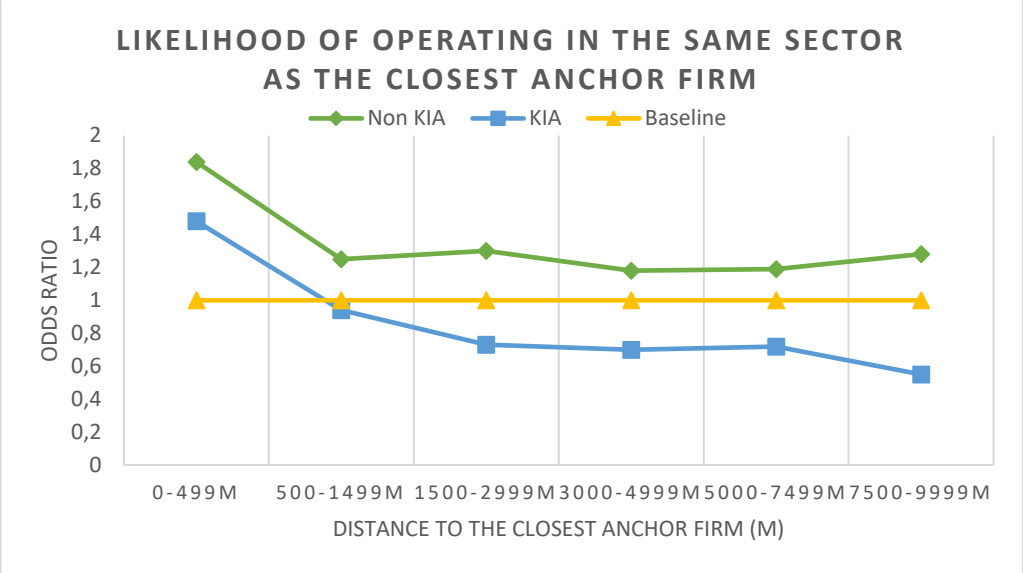

Figure 11: Likelihood of operating in the same sector as the closest anchor firm

This indicates that the location choices in terms of the importance of being located close to an anchor firm of these sector groups differs quite a lot. For knowledge-intensive firms this appears to be very important as after the relative high likelihood for close distances, the likelihood decreased even under the baseline, indicating that the likelihood of a knowledge-intensive firm operating in the same sector as the closest anchor firm is lower between 1,5- and 10 kilometers opposed to knowledge-intensive firms located over 10 kilometers away from the closest anchor firm. This suggests a notion of knowledge-intensive firms want to be located very close the anchor firm or not want to be close at all. This can probably also be related to urban dynamics as anchor firms are predominantly located in cities, therefore related firm want to be located near these anchor firms in the cities however when not possible within a certain range (probably 1500 meters) it is probably cheaper (the costs outweigh the externalities) to locate further away outside the city, explaining the lower likelihoods between 1,5-10 kilometers. Moreover, in light of academic theory this is not necessarily surprising as knowledge spillovers only transfers over short distances, as close as just 1 kilometer as Andersson et al. (2016) argue in their paper, which is almost perfectly in line with these findings. However, what causes the lower likelihood in between 1,5 and 10 kilometers? It appears that this can be explained by the firm location choices of the anchor firms rather than the smaller firms. As Colombo & Dawid (2014) argue 'leading firms', being

advanced firms in their respective sectors, can benefit from being located relatively isolated opposed to be located in a cluster as the firm advantage exceeds a certain threshold, putting the competition at a distance, literally, in order to maintain the gained advantage, it is highlighted that these patterns are especially present for firms investing heavily in R&D (Colombo & Dawid 2014), which in our denomination are labelled as knowledge-intensive firms.

The question also remains, why the likelihood of non-knowledge intensive firms lingers above the baseline of firms located 10 kilometers or further away from the anchor firm. As these firms do not necessarily rely on knowledge spillovers, or only do to a smaller extent, the effect of anchor firm externalities is less localized as the factors of the availability of a skilled labor pool as well as the specialized supplier relationships have larger spatial extents as previously discussed in the theoretical framework (Frenken et al., 2006; Andersson et al., 2016; Paci & Usai, 2000).

Secondly, do knowledge-intensive firms experience different firm employment growth rates in relation to the distance from the closest anchor firm opposed to non-knowledge-intensive firms?

As can be seen from figure 12 on the next page, there are indeed some differences, but also a similarity as the spatial extent of both groups is similar observing higher growth rates until 1500-3000 meters, stabilizing from that point onwards to the average level of firm employment growth. However, the level at which the firm employment growth stabilizes differs as the firm employment growth rate of knowledge intensive firms stabilizes around 2%-point (1500-3000m onwards) after an initial peak of 2,7%-point (0-499m), whereas the firm employment growth rate of non-knowledge intensive firms stabilizes around 0,6%-point (1500-3000m onwards) after an initial peak of 1,3%-point (0-499m).

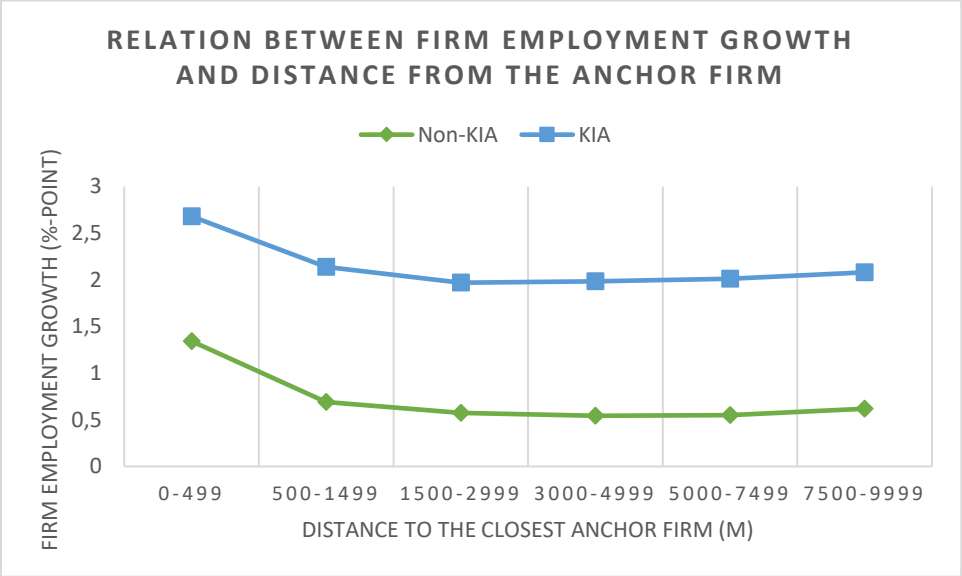

Figure 12: Relation between firm employment growth and distance from the anchor firm

In terms of the spatial extent of the effect, higher firm employment growth rates resulting from being located close to an anchor firm, there is not a big difference between knowledge-

and non-knowledge intensive firms, the spatial extent also does not differ from the overall spatial extent as found in section 4.3.1. However, why do the firm employment growth rates stabilize at different rates? This explanation is rather simple as the Netherlands is a knowledge economy, a tertiary economy, in which most people are employed to provide a certain service, rather than producing tangible goods. Knowledge-intensive firms often hire people in order to accommodate their growth, whereas non-knowledge intensive firms often accommodate their growth by investing in capital, for example in machines/robots (Becker, 2017), this has and will become more prevalent in the realm of automatization in which machines/robots take over tasks which are routine and repetitive, often found in non-knowledge intensive firms, while it also creates new jobs (and possibly firms) focused on for example the development of such systems (Frey & Osborne, 2017), which can be regarded as a knowledge intensive activity.

4.4.2 Differences across sectors: common grounds, big differences

As previously discussed in the theoretical framework it would not be unlikely as the spatial extent of anchor firm externalities differs based on the sector the anchor firm and other nearby firms are operating in, as these firm rely differently on the components of localization economies (Frenken et al., 2006). This already is partly confirmed in section 4.4.1 were differences were found between knowledge-intensive firms and non-knowledge-intensive firms. In this section there will be elaborated on possible differences between five sector-groupings: Manufacturing & Utilities, Low-end services, High-end services, Public administration & Education and Healthcare.

As can be seen from figure 13 below, our hypothesis that there are different dynamics across sectors in relation to anchor firm externalities is confirmed. The corresponding tables can be found in the appendix, the corresponding regression outputs can be acquired by acquiring the author.

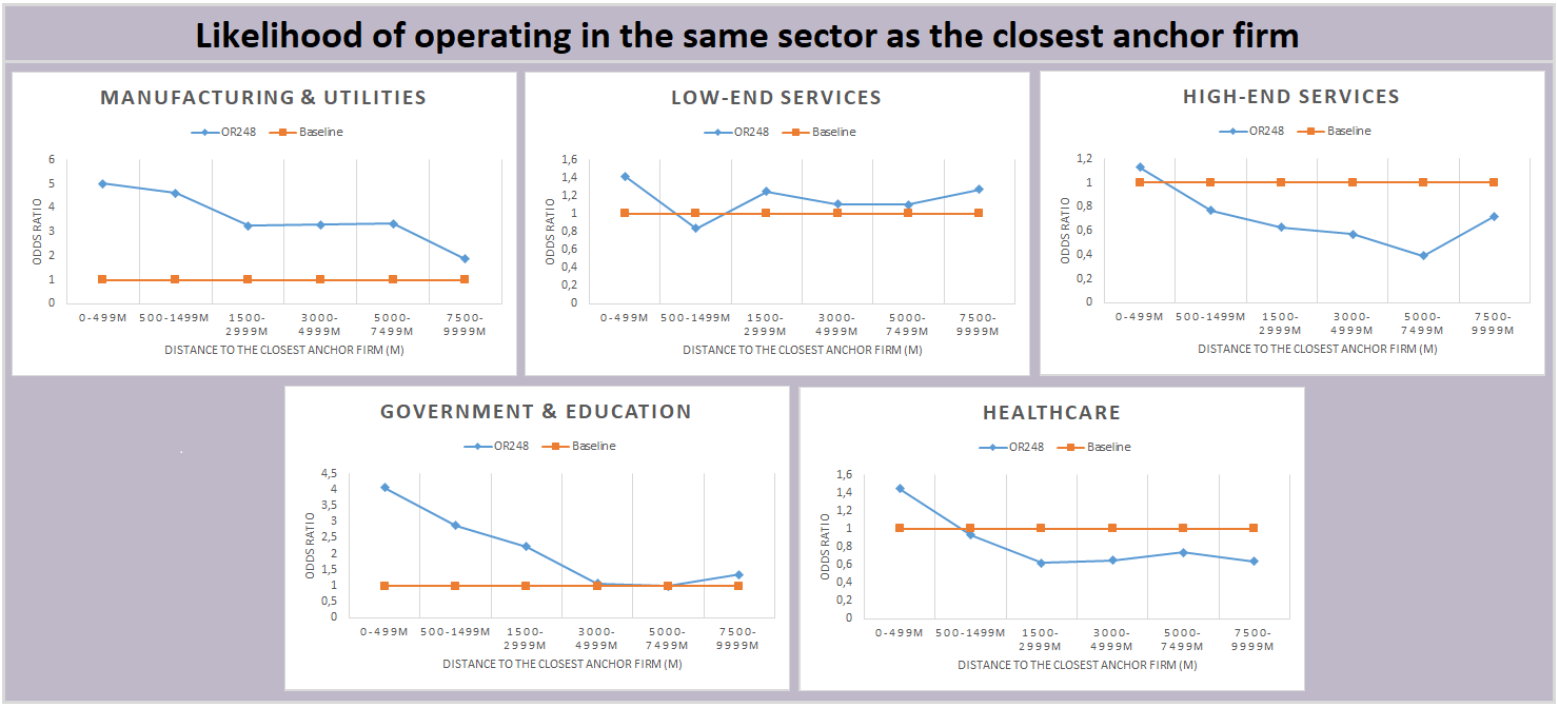

Figure 13: Likelihood of operating in the same sector as the closest anchor firm

In fact, it gives a rather diverse image, starting with manufacturing & utilities it shows, based on the high likelihood, that it is rather important to be located close to an anchor firm, however this does not necessarily mean that firms all want (and need) to be located 'at the gate' of the respective anchor firm, as this high likelihood remains high until 7500m, after which it is rapidly decreasing to the baseline of firms located more than 10 kilometers away from the closest anchor firm.

As firms in the manufacturing & utilities sectors rely more on the availability of a skilled labor pool and the specialized supplier relationships toward the anchor firm (Spencer, 2013). It is necessary for them to be located close in order to benefit from those anchor firm externalities however, since these firms often do not operate in knowledge intensive activities it is not necessary to be located that close as knowledge spillovers are of lesser importance (Spencer, 2013), this allows these firms to be located somewhat further away from the anchor firm and therefore it might be cheaper in terms of for example land prices to be located a couple kilometers away, while it can still benefit from the specialized supplier relationships to the anchor firm as well as the availability of an skilled labor pool adhering to the anchor firm.

The low-end services show a somewhat similar pattern, although the likelihoods are not that high compared to the manufacturing & utilities sectors. Also, there is a downward peak between 500-1499 meters, which deviates from the overall trend of an odds ratio around 1,2 until 10 kilometers. It appears that it is somewhat important for firms operating in low-end services to be located close to an anchor firm. However, there is hardly any distance decay visible apart from the unexplained downward peak, and there only is a slight contrast to the baseline of firms located further away than 10 kilometers (Odds ratios around 1,15 compared to 1).

Therefore, it can be concluded that anchor firm externalities are hardly of any importance to firms operating in the low-end services sectors and according to theory of reliance on the different components of localization economies (Frenken et al., 2006) this is not that surprising as these sectors are not knowledge-intensive, so knowledge spillovers are of lesser importance. Since, it deals with services there are hardly any specialized supplier relationships, and there is little need for skilled labour.

The high-end services however show a pattern very similar to the knowledge-intensive firms sample, which is not surprising as there is a big overlap between the two samples, namely an initial localized peak (0-499m) after which the likelihood rapidly declines even under the baseline average. As knowledge spillover are very important to these firm it is important for them to be located closely to an anchor firm as knowledge spillovers only occur over short distances (Andersson et al., 2016). However, if an anchor firm has reached an certain threshold of an advantage over the other firms it might (choose to) isolate in order to maintain their advantage (Colombo & Dawid 2014), as this possibly explains the lower likelihood of operating in the same sector until 10 kilometer after the initial localized peak of a high likelihood of being operating in the same sector as the closest anchor firm.

For 'firms' operating in the public administration & education sectors it also is important to be located close to an anchor firm regarding the high likelihood for close distances, which

likelihood rapidly declines to the baseline at 3000-4999m. Which is a somewhat larger spatial extent compared to previous samples. This can be explained by the fact that knowledge spillovers are important in this sector, explaining the initial peak. However, it is also beneficial from a labor-mobility point of view as these 'firms' can attract freshly graduated employees from the universities (of applied sciences), as labor-mobility externalities have a large spatial extent (Paci & Usai, 2000; Anselin et al., 2000) this explains the somewhat larger spatial extent of anchor firm externalities in this sector group. Moreover, as 'firms' in these sectors are (semi-)state-regulated in the context of the Netherlands, especially the anchor firms are often located in central locations, either in/near city-centers and/or (business)campuses, meaning that firms are often located relatively close by default, explaining why the likelihood is almost equal to the baseline after 5 kilometers.

Finally, the healthcare sector, this again shows a similar pattern to the high-end services sample and thus the knowledge-intensive firms' sample, which is also not surprising as especially the anchor firms in this sector operate in knowledge-intensive activities, such as developing medicine, studying diseases in (academic) hospitals or other institutes. As knowledge spillovers also play a big role in this sector (Spencer, 2013) the localized nature of the likelihood of operating in the same sector as the closest anchor firm is explained indicating the localized spatial extent of anchor firm externalities

In terms of the relationship between firm employment growth and the proximity to the closest firms all sector groupings show very similar results as the overall patterns are almost identical, as can be seen from figure 14 on the next page, showing an initial peak at 0-499m, slowly decreasing, stabilizing at/around 1500-2999m. Only, the firm employment growth rates of the public administration and education sectors are more stable over distance. However, the growth rate at which the effect stabilizes, as well as the height of the initial peak does differ between the different sector-groupings.

The services, both low- and high-end services, show the lowest firm employment rates in relation to the proximity of an anchor firm, with an initial peak around 0,8%-point, stabilizing around 0,2%-point. While in the healthcare sector the peak lies at 1,15%-point, stabilizing around 0,5%, and as previously mentioned the firm growth rates for the public administration & education sectors remain rather stable as the initial peak lies at 1,2%-point while it already stabilizes around 0,9%-point. The highest initial peak can be found in the manufacturing & utilities sector grouping, with a peak of 1,55%-point, stabilizing just above 0,9%-point.

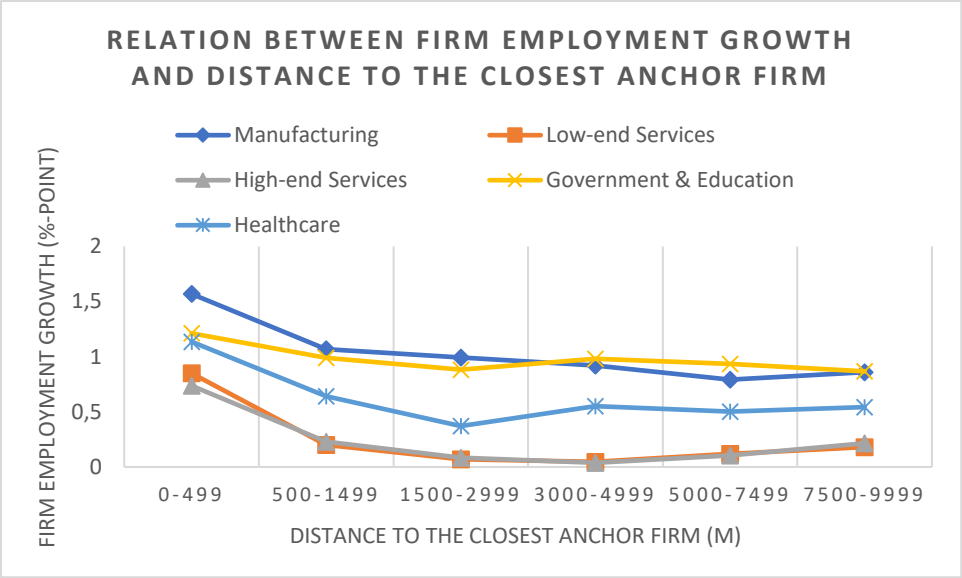

Figure 14: Relation between firm employment growth and distance from the anchor firm

So, what explains these differences? These differences can mostly be attributed to market effects, which unfortunately could not be included in the regression analysis. The firm employment growth rates for certain sectors rely mostly on the fact whether there is a sufficient market demand, if there is a big demand for manufacturing products the firm employment growth rate increases and vice versa. And as demand for certain products in different markets, different sectors, differ from time to time it explains the different in the level of the firm employment growth rates, which has already discussed show a similar pattern in distance decay of a declining firm employment growth rates when distance to the closest anchor firm increases.

However, there is one sector group that shows a slightly different pattern: why does the government & education group show a subtler distance decay in the declining firm employment growth rates in relation to the distance to the closest anchor firm? Where most sector groups show a difference between the peak (0-499) and the stabilized level (1500-2999 onwards) of about 0,6%-point, indicating the maximum premium of being located close (0-499m) to an anchor firm in terms of additional firm employment growth. Whereas, at the government & education sector group, there only is a 0,3%-point difference between the peak (1,2%-point at 0-499m) and the stabilized level (around 0,9%-point at 1500-2999 onwards).

This difference might be explained, as ‘firms’ in the government and education sector group are not entirely market-driven and state-regulated to some extent. As governments and educational institutions serve as almost as a right to the people, especially in the Netherlands, having these services available and accessible for all. Meaning that these ‘firms’ are obliged (by law) to locate at a non-market optimal location, for example it might be beneficial for educational institutions to locate in one place, for example near an anchor firm (an university in this example) in terms of maximizing knowledge spillovers, however in order to keep education accessible these institutions are spread across regions, which explains the more subtle stabilization of firm employment growth rates in relation to the distance to the closest anchor firm in the government and education sectors.

4.4.3 Does firm size matter?

In order to assess the robustness of the results, the analysis was carried out using three samples, which were all derived based on a different anchor firm size. In the section below the results of these alternative samples will be reflected upon in relation to the main sample, answering two questions: do the results hold in the other samples (robustness) and is there some sort of size effect? Do bigger anchor firms in certain sectors have a larger spatial extent of anchor firm externalities?

While the results follow the same analogy compared to the results of sections 4.2.2 and 4.3.2, the results are discussed in a more compact graphical manner in order to keep the whole comprehensible as it deals with many sub-samples of the different sector-groupings. The corresponding tables can be found in the appendix, the corresponding regression outputs can be acquired by acquiring the author.

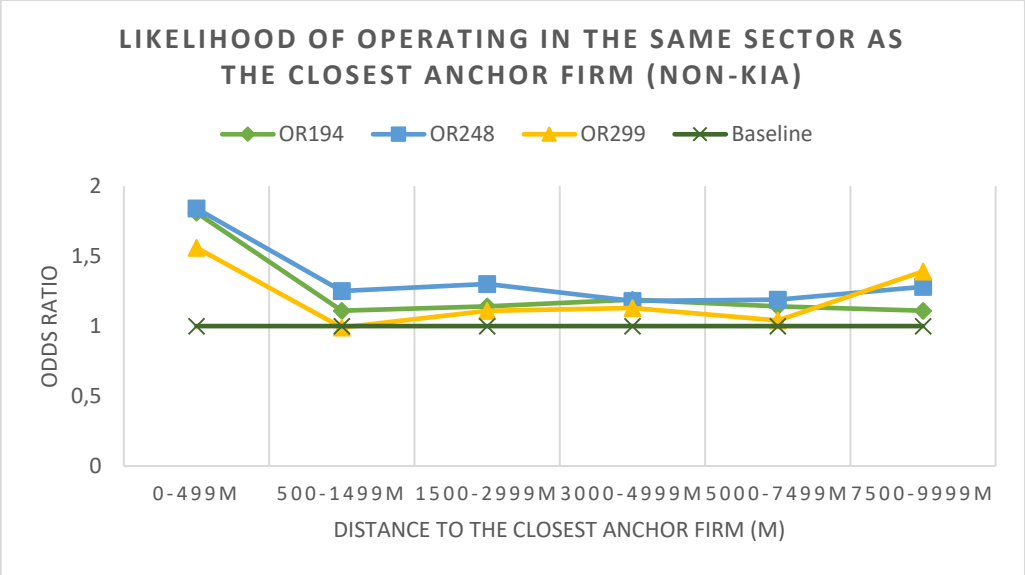

Figure 15: Likelihood of operating in the same sector as the closest anchor firm

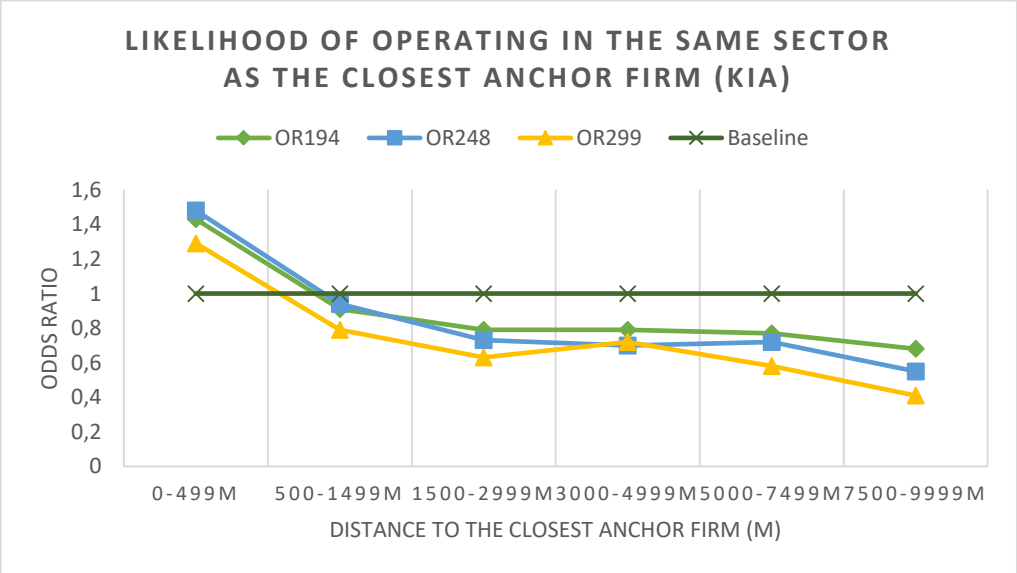

Figure 16: Likelihood of operating in the same sector as the closest anchor firm

As can be seen from figures 15 and 16 on the previous page, in which the alternative samples for knowledge-intensive firms (KIA) and non-knowledge-intensive firms (Non-KIA) are displayed differentiated based on different anchor firm thresholds of respective 194+ and 299+ employees in comparison to the main sample of 248+ employees, it becomes clear that size at these levels does barely influence the likelihood of an firm operating in the same sector as the closest anchor firm, indicating that there are virtually no differences in the spatial extent of anchor firm externalities. Moreover, the lines almost follow the exact trajectory of the main samples, from which can be concluded that the results can be regarded as robust.

In terms of the relationship between firm employment growth and the distance to the closest anchor firm, there are only marginal differences in terms of the course of the distance decay between the different size-samples, therefore concluding that the results are robust. However, it is note-worthy that non-knowledge intensive firms in the 194 sample, at which the threshold of being labelled as an anchor firm was lowest, show a consequent lower firm employment growth rate compared to the main and 299 sample, indicating a size effect. However, as previously discussed in the final part of section 4.3.2 it might also be that the sample is lightly distorted by firms wrongly labelled as anchor firms, while these firms do meet the employee threshold but lack the additional characteristics of an anchor firm.

Similarly, knowledge-intensive firms in the main sample (at which the anchor firm threshold was determined at +248 employees) consequently shows higher firm employment growth rates than the alternative samples of 194+ and 299+ employees, which is odd as it is the middle/average sample that indicates a size-effect, whereas a lower effect for the 194+ sample or a higher effect for the 299+ sample would have appeared to be more likely, it might be the case that an anchor firm size of around 248 employees is a sort of a ‘sweet-spot’ at which nearby firms benefit optimally, as the externalities of small (194+) knowledge-intensive anchor firms are too small, while large (299+) knowledge-intensive anchor firms become a too closed environment, for similar reasons they sometimes isolate (Colombo & Dawid, 2014), from which nearby firms cannot benefit optimally, the corresponding figures can be found in the appendix.

In terms of the relationship between firm employment growth and the distance to the closest anchor firms across different sectors, there are indeed some interesting patterns visible assessing figure 17 below. The first thing to notice is that the results have become more capricious as the samples become relatively small at this stage differentiating both on firm size and sector, this is especially true for some of the sectors.

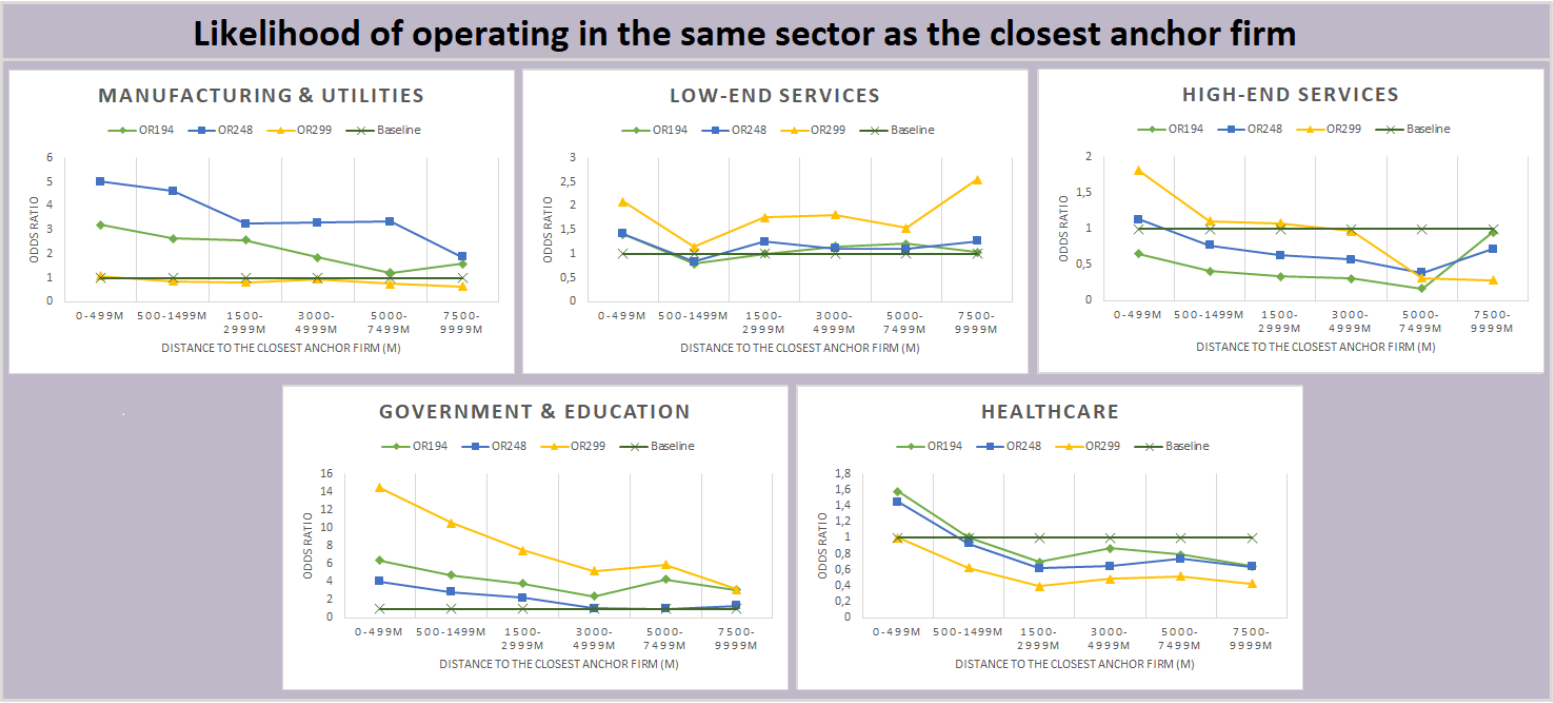

Figure 17: Likelihood of operating in the same sector as the closest anchor firm

In general the same patterns remain visible, the alternative sample often only deviate marginally (apart from some unexplainable bumps) from the main sample in terms of the trajectory of the distance decay in the likelihood of an firm operating in the same sector as the closest anchor firm often showing an initial peak at the closest distance, rapidly decreasing and stabilizing at some point, often around the 1500-2999m mark, from that perspective the results can be regarded as mostly robust.

In terms of size-effects, there are some interesting differences. In the manufacturing and utilities sectors both alternative samples, based on smaller and bigger anchor firms compared to the main sample, show lower likelihoods of firms operating in the same sector as the closest anchor firm compared to the main sample, however as said the results are somewhat capricious.

In the low-end services sectors there is a clearer pattern, while the 194+ sample is showing a similar trajectory, the 299+ sample consequently shows higher likelihoods of firms operating in the same sector as the closest anchor firm, as can be seen from figure 17, the likelihood of this subsample remains above the baseline, suggesting a larger less localized spatial extent of anchor firm externalities for bigger anchor firms (299+ employees) in the low-end services sectors. As low-end service sectors do not heavily rely on knowledge spillovers necessarily, there is little need to be located really close to an anchor firm, however as the anchor firm generates the availability of a skilled labour pool at a certain stage, it is beneficial for firms to

be located in the vicinity of an anchor firm as it can benefit from the availability of this skilled labour pool. However, since the spatial extent of the skilled labour pool externality is larger than for example the spatial extent of knowledge spillovers (Paci & Usai, 2000), firms are not bound to be located really close to the anchor firm, but can allow themselves some distance in order to still profit from the skilled labour pool adhering to the anchor firm, explaining the higher likelihoods until 10 kilometers of a firm operating in the same sector as the closest anchor firm.

In the high-end services sectors there also is a clear pattern as initially the 299+ sample, based on bigger anchor firms shows higher likelihoods until 3000-4999m, after which the pattern shifts, and it shows lower likelihoods from that point onwards compared to the main sample, while the opposite is true for the 194+ sample, based on smaller anchor firms. As these sectors do rely on knowledge spillovers to a greater extent, the initial localized peaks are explained (Andersson et al., 2016), however, what explains these turning points of the alternative samples from 3000-4999m onwards? These turning points highlight the importance of knowledge spillovers in these sectors as firms want to be located as close as possible, especially to the larger anchor firms in this sector (299+), which after the initial peak remains rather stable above the baseline until 3000-499, after which it rapidly declines well under the baseline as firms from that spatial extent onwards barely profit from the knowledge spillovers of the anchor firm (Andersson et al., 2016). In terms of the smaller anchor firms in the high-end sectors, it seems somewhat more complicated. First of all, the initial peak is rather modest, slightly above the baseline, indicating that firms in these sectors having over 194 employees do not necessarily function as an anchor firm yet, limiting its externalities. Moreover, as the amount of anchor firms in the sample based on the smaller anchor firms (194+ employees) is still rather substantial and rather spread out across the Netherlands as can be concluded from figure 4 in section 4.1.2, it remains questionable whether the upward turning point for the 194+ sample is an effect or a distortion resulting from the disparity between the operationalization of the anchor firm definition and the real-world phenomenon itself, as another (mislabeled) anchor firm might be already within 10 kilometers from the firm.

In the government & education sector it appears that the smaller sample (194+) is rather similar to the main sample although showing higher likelihoods of firms operating in the same sector as the closest anchor firm, which is a little odd as you would expect the opposite, especially since the sample based on larger anchor firms (299+) in the government and education sectors shows very high likelihoods, especially until 1500-2999m, of firms operating in the same sector as the closest anchor firm. Of course, knowledge spillovers play a big role in these sectors (Spencer, 2013) indicating the high likelihoods and the rapid decline after the initial peak, however, and this is especially true for bigger anchor firms in these sectors (299+ employees), these are more than often located in central locations, either near a city-center, business district or (business) campus, meaning that other firms (from the same sector) are almost always closely located by default, amplifying the anchor firm effect in terms of size.

Finally, the healthcare sector, the sample based on smaller anchor firms (194+) almost shows similar results to the main sample. The sample based on larger anchor firms (299+) however,

consequently shows lower likelihoods of firms operating in the same sector as the closest anchor firm, even to the extent that the likelihood of the closest category (0-499) is barely above the baseline (1). This can be explained in two ways: first, the healthcare sector, needs to be available/accessible for all people meaning that the bigger anchor firms (299+), being hospitals, medical centers are spread, not necessarily close to other firms in order to optimize the accessibility. Secondly, another subsector in the healthcare industry is the development of medicine, on the one hand knowledge spillovers can play a big role (Spencer, 2013), however competition between pharmaceutical firms is big as these firms make their money with the exclusive right on newly-developed medicine and they do not want their competitors to come up with it first, a centrifugal force towards isolation of the anchor firm (Colombo & Dawid, 2014).

In terms of the relationship between firm employment growth and the distance to the closest anchor firm differentiated by anchor firm size and sector, there are some interesting results as can be seen from figure 18 below. As in most cases the lines of the alternative samples follow the same or similar trajectories compared to the main sample, the results can be regarded as robust.

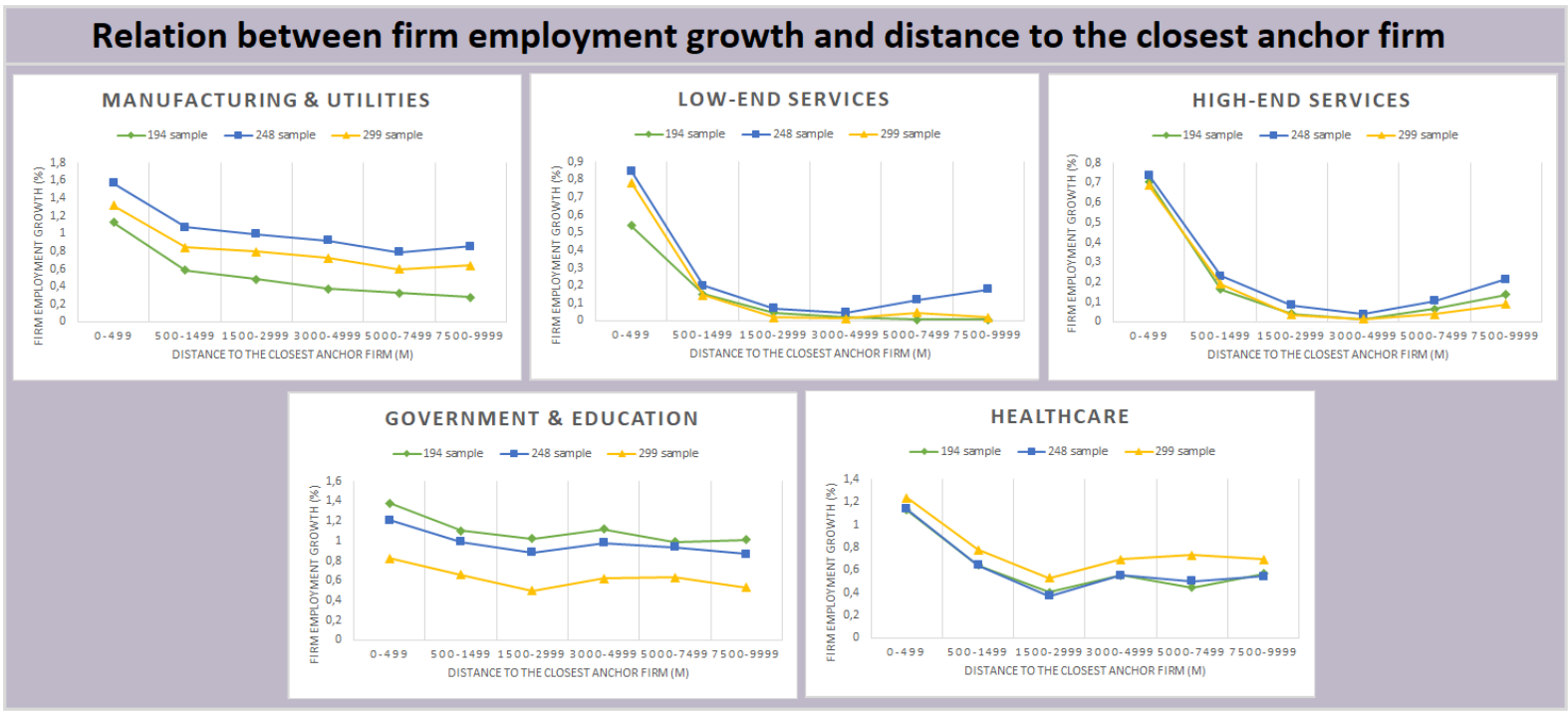

Figure 18: Relation between firm employment growth and distance from the anchor firm

However, there are also note-worthy differences apart from the similar trajectories. As for example in the manufacturing & Utilities sectors, both alternative sample show lower firm employment growth rates in relation to the distance to the closest anchor firm. As discussed previously, it appears that an anchor firm having just over 248 employees is a sort of a 'sweet-spot' at which nearby firms benefit optimally, as the externalities of small (194+) manufacturing anchor firms are too small, while large (299+) manufacturing anchor firms become a too closed environment, for similar reasons they sometimes isolate (Colombo & Dawid, 2014), from which nearby firms cannot optimally benefit.

The low- and high-end service sectors show rather similar results, in which all sub samples based on the anchor firm size show similar trajectories, however when zoomed in it also appears for these sectors that firms located close to anchor firms of just over 248 employees (the main sample) perform slightly better than firms located closely to smaller and larger anchor firms, punctuating the suspicion of a 'sweet-spot' for anchor firm size.

In terms of the government & education sectors, the subsamples show similar trajectories. However, it appears that when the size of the anchor firm increases, the firm employment growth is lower for nearby firms, indicating that smaller anchor firms in the government and education sectors have smaller externalities and vice versa. Probably due to the fact that bigger anchor firms in these sectors become a too closed environment in which nearby firms are not able to benefit optimally from the presence of the anchor firm.

Finally, the healthcare sector, while the main sample and the alternative sample based on smaller anchor firms virtually show the same result, the sample based on larger anchor firms in the healthcare sector consequently shows somewhat higher firm employment growth rates for nearby firms, what explains this size-effect? It is probably a mix of the availability of a skilled labour pool, which is more substantial at a large size anchor firm, as well as a higher likelihood of spin-offs as the anchor firm might become to 'rigid' because of its size, resulting in former employees starting for their own (Klepper & Sleeper, 2005), eventually reaching higher firm employment growth rates as these spin-offs are not withheld by their size (yet).

5. Conclusion and Discussion

In this final chapter of this master thesis, the conclusions will be drawn and there will be critically reflected on the outcomes of this research along with a discussion on the implications of the results to firms, governments and society as a whole. Finally, based on the reflection and advancing insights, suggestions will be made for further research in order to enhance and counterbalance the results of this thesis.

5.1 Conclusions

In essence, this thesis dealt with the relationship between anchor firms and other firms surrounding the respective anchor firm. To be more precise: *'What is the spatial extent of labor market- and sector effects of anchor firms in the regional economy in the Netherlands?'* Which is the main research question, that was answered built on the answers of the four sub questions.

Concerning the first sub question, 'what is the spatial and sectoral distribution of anchor firms in the Netherlands?', it became clear that anchor firms are not necessarily bound to specific locations and can be found across the Netherlands. However, anchor firms are most present in urban areas, especially in the four major Randstad cities (Amsterdam, Rotterdam, The Hague and Utrecht), also some regional urban centers showed a high presence of anchor firms, such as Groningen, Twente, Arnhem-Nijmegen, Eindhoven and the Maastricht area.

In terms of the sectoral distribution, it became clear that there is a wide variety of anchor firm presence across sectors. While three sectors, manufacturing, healthcare and public administration, are responsible for just over half (53%) of all anchor firms in terms of firm size, in other sectors the anchor firm is virtually non-existent, like in the culture, sports & recreation and the hospitality sectors (<0,9% of all anchor firms).

The second sub question was: *'what is the spatial extent of positive externalities from the anchor firm in terms of the sector structure of related firms?'.* Our hypothesis was that firms nearby the anchor firm had a higher likelihood of operating in the same sector as this anchor firm, while this likelihood declines with distance from the anchor firm.

This hypothesis can be confirmed, firms located within 500 meters from an anchor firms, are almost twice as likely to be operating in the same sector as the anchor firm compared to first located over 10 kilometers away. However, this likelihood rapidly decreases, and the effect becomes virtually non-existent after 3 kilometers. So, until three kilometers there is a higher likelihood of firms operating in the same sector as the anchor firm, this indicates that, corrected for other factors, that these firms acquire benefit from being located near the anchor firm, an indicator that the anchor firm externalities, being knowledge spillovers, specialized supplier relationships etc. have an effective spatial extent of roughly 3 kilometers.

Thirdly, it was assessed whether the spatial extent of anchor firm externalities could also be derived from the firm employment growth rates of nearby firms, that led to the following sub question: 'what is the spatial extent of positive externalities from the anchor firm in terms of firm employment growth of related firms? Our hypothesis was that nearby firms observed

higher firm employment growth rates compared to firms located further away, as those firms are less able to benefit from these anchor firm externalities.

And this hypothesis was also confirmed, as firms located within 500 meters from the anchor firm show firm employment growth rates of around 1,4%-point, whereas firms located further away, from 3000 meters onwards only show firm employment growth rates of around 0,7%-point. This means that firms located within 3000 meters from an anchor firm experience higher firm employment growth rates up to 0,7%-point when located within 500 meters, this premium indicates that up to 3 kilometers there are anchor firm externalities present from which firms derive higher firm employment growth rates opposed to firms located further away, such as knowledge spillovers, specialized supplier relationships and the availability of a skilled labour pool (Marshall, 1920).

Finally, the legitimate question was asked whether these results are the same for each sector or that there are different dynamics across these sectors. Resulting in the final sub question: *'what are the sectoral differences in the spatial extents of the labor market- and sector effects?'*. And the hypothesis was that there are indeed differences, to be more precise it was argued that anchor firm externalities in knowledge-intensive sectors have a smaller spatial extent as knowledge spillovers are most important, while these transfer over relatively short distances (Andersson et al., 2016).

This hypothesis could only be partly confirmed. In terms of the likelihood of a firm operating in the same sector as the closest anchor firm, it became clear that firms operating in knowledge-intensive activities (KIA), showed a smaller spatial extent indicating anchor firm externalities to a maximum of just 1500m, whereas firms not operating in knowledge-intensive activities (NKIA) showed a rather stable image of higher likelihoods even until 10 kilometers indicating minor presence of anchor firm externalities at this very distance. However, in terms of the spatial extent of the externalities regarding the firm employment growth rates, there was hardly any difference, both reaching to a maximum of 3000 meters from the anchor firm, however the level of the firm employment growth rates was significantly higher for knowledge intensive firms opposed to non-knowledge intensive firms, 2,68%-point over 1,35%-point for the closest category (0-499m), as this 'gap' remains constant over distance.

When zooming in to five sector groups, the results showed the same pattern, in terms of the firm employment growth levels, the spatial extent of anchor firm externalities is virtually the same, again with differing levels of firm employment growth rates remaining constant over distance, but in all cases to a maximum of 3 kilometers. However, in terms of the likelihood of a firm operating in the same sector as the closest anchor firm, there were again some differences. Whereas, the most knowledge intensive sector groups (high-end services & healthcare) showed strongly localized effects of anchor firm externalities to a maximum of 1500 meters, the non-knowledge intensive sector groups (low-end services & manufacturing) showed more stable spatial extent of indicated anchor firm externalities even with a minor presence up to 10 kilometers. Lastly, the government & education sector group showed a similar trajectory to the knowledge intensive sector groups, however the indicated effect lasted slightly longer to a maximum of 5 kilometer, which can be explained from the function

these ‘firms’ have, as governments and educational institutions must be available and accessible to all people in the Netherlands, therefore causing them to spread across regions.

Overall, regarding the research question stating: *’What is the spatial extent of labor market- and sector effects of anchor firms in the regional economy in the Netherlands?’,* it can be concluded that the spatial extent of labor market and sector effects of anchor firms is in general bound to a maximum of 3 kilometers. This spatial extent differs as externalities of knowledge intensive anchor firms show a smaller spatial extent, as they rely more on knowledge spillovers, which generally transfer over shorter distances (Andersson et al., 2016), while the spatial extent of non-knowledge intensive anchor firms is somewhat larger as these rely more on the specialized supplier relationships and the availability of a skilled labor pool, which effects are less limited in terms of distance (Malmberg & Maskell, 2002; Paci & Usai, 2000).

5.2 Implications

Now that the research questions have been answered, there will be reflected on the implications, which reflects on the last few words of the research question: what it actually means to the regional economy in the Netherlands and its policy-makers.

In the introduction of this thesis, the case was discussed of a distribution center of a fashion-giant in Lelystad, creating about 400 jobs. The province of Flevoland was convinced of the economic benefits to province, because the province thinks that the presence of this firm will enhance the formation of SME’s, establishing an ecosystem of suppliers in the province of Flevoland (Province of Flevoland, 2017). And according to this research, there is some truth to that as there are indeed higher likelihoods of firms operating in the same sector and higher firm employment growth rates. However, these only last to around a maximum of 3 kilometer, so it is highly questionable whether it benefits the entire province of Flevoland, most likely not. This does not necessarily mean that the subsidy of almost €3 million is lost, but the benefits are only more localized, if the goal was to enhance Lelystad economically the subsidy is fine, however in order to enhance the economy of the entire province the subsidy probably falls short of meeting its goal.

Therefore, the results of this research give local and regional governments a ‘tool’ to assess the spatial extent of a certain anchor firm. Is it really necessary to attract an anchor firm to that specific place or is it better to attract or maintain it in another place? Do the positive externalities of a certain anchor firm allocate to our municipality/province or does most of it allocate to a neighboring jurisdiction, if so is it worth to develop this even area further? The results of this research help to answer these questions and help policy-makers to facilitate a more durable business environment in which the economic potential of anchor firms along with related firms are fully utilized providing innovation, economic growth and employment.

5.3 Discussion

In order to fully understand and interpret the results and conclusions in a rightful manner, the weaknesses of this research along with its strengths will be discussed in the section below.

First, it is important to understand that the operationalization of the anchor firm definition used in this result is not perfect as previously mentioned throughout the thesis. According to the leading definition by Agrawal & Cockburn (2003), an anchor firm can be characterized as a large firm having a local presence primarily focused on Research & Development (R&D). However, in order to assess the anchor firm phenomenon at national-scale, the compromise has been made to limit the operationalization to large firms (over 248 employees). Although this threshold is carefully chosen using a k-means clustering technique as discussed in the methodology, it cannot be ignored that the samples are slightly distorted as some firms might be wrongfully labelled as an anchor firm while other anchor firms are wrongfully labelled as a 'regular' firm. On the other hand, by assessing two alternative samples, using different firm-size thresholds, the robustness of the results was tested. Moreover, given the likely slight distortion of the anchor firm sample, the research still showed significant results, which adds to the strength of the outcome. However, the limited operationalization of the anchor firm definition should be taken into account when discussing the results of this research.

Another operational shortcoming of this research that cannot be ignored is the assessment of the effect. One way to assess the spatial extent of the anchor firm externalities was to look at the likelihood of firms operating in the same sector nearby and further away from the anchor firm, as an indicator for the anchor firm externalities, as it is argued that these firms benefit from the anchor firm and therefore chose to locate close to the anchor firm. Concluding that the point at which there are no more firms operating in the same sector as the anchor firm located compared to the reference category of over 10 kilometers from the anchor firm marks the spatial extent of anchor firm externalities. Although we found this relationship, it cannot be regarded as a causality, maybe (some) firms are 'randomly' located close to an anchor firm for other reasons, despite the models were corrected for firm density, population density and distance to other points of interest for example adding the distance to the second-closest anchor firm, educational institutions and transportation hubs. Reasons that might not be even quantifiable in the first place, like family-related matters, or the general business climate apart from the proximity to the anchor firm.

In addition, although the results are proven statistically significant, the explained variances indicated by the (pseudo) R^2 are on the low side. Although given the method (rare-event logistic regression) as well as explained phenomenon high R^2 were not expected but with (pseudo) R^2 ranging between 0,10 and 0,20 for most samples, it must be regarded on the lower side. Meaning that there are various other factors influencing the location-choices of firms in relation to the anchor firm outside of the used (control) variables. For example, sector specific location factors, firm-specific location factors, personal factors, path-dependency, and even chance.

There must be reflected on the timeframe of the used LISA dataset, the starting year of the data is 2008, which is the year the economic crisis started, as the firm size of this year is used

to calculate the annual firm employment growth rates, these rates might have been distorted as, dependent on the reference date, some firms have already fired some employees or were about to do so, which might lead to firm employment growth rates not showing the actual performance of the firm. Moreover, as it is required to have the firm size information of two years in order to calculate a firm employment growth rate, firms with only present in the dataset for one year only are excluded from the OLS regression in which firm employment growth was the dependent variable. However, these firms are still there, although being there for a short period of time, this must be considered when assessing the results.

Finally, it needs to be pointed out that the results are specific to the Netherlands, as the Netherlands is a very densely populated country both in people and in firms, the results can be one-on-one compared to other countries. It would not be surprising that the spatial extent of anchor firms in other countries with other business dynamics, less densely populated show different results. Also, as the Netherlands in part of the European Union, it allows free movement of production factors across national boundaries, it is possible that Dutch firms are benefiting from anchor firm externalities from German and Belgian anchor firms, while there might also be firms in these countries to benefit from Dutch anchor firms, as the LISA dataset is bounded to the Netherlands, these cross-border anchor firm externalities are not included in to the research.

5.4 Further research

Finally, this research was not only built on the analysis of secondary data, but also built forward on previous academic literature, with the aim to fill a research gap. In order to enhance and/or counterbalance the results of this thesis, some suggestions for further research are proposed below.

This research distinguished itself by the large scale the phenomenon was researched (nation-wide) making use of the business register (LISA). Therefore, an operationalization was used based on firm size, while there are also other components to the anchor firm definition, it would be a good suggestion to focus on another component of the anchor firm definition, the R&D orientation and local presence. For example, by including data on patents issued to (anchor) firms and examining the actual links (interactions) between firms at a more local scale.

Another option would be to start a case-study to one or more anchor firms across various sectors in which quantitative data is supplemented by qualitative data, for example interviews or ‘qualitative surveys’ in which the linkages between the anchor firms and firms can be assessed in depth, zooming in on what the anchor firm externalities actually are and mean to the anchor firm and related firms.

In this light it can also be assessed whether there are different perceptions on the importance of and the spatial extent of anchor firm externalities in light of the anchor firm and the other firms, maybe anchor firms are keen to stress their importance in order to bring in local

subsidies, while other firms argue that the importance of the respective anchor firm is rather limited.

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7. Appendices:

Appendix 1: descriptive statistics of distance variables (194 sample)

Distance variables in meters (m) - 194 sample	Mean	Std. Dev.	Min.	Max.
Distance to Anchor Firm	1222	1711	0	29742
Extra distance to 2nd Anchor firm	482	1021	0	13040
Distance to University (WO)	15368	15297	0	101189
Distance to University of Applied Sciences (HBO)	11700	11239	0	66823
Distance to Vocational college (MBO)	7940	8230	0	42922
Distance to international airport	28770	19425	0	92402
Distance to train station	4772	5603	400	59000
Distance to Highway	1828	1329	100	46300
Cumulative distance to basic services*	11241	7853	2200	96000
Cumulative distance to recreational services*	44966	28243	7900	267600
Cumulative distance to retail services*	7398	5019	900	48800

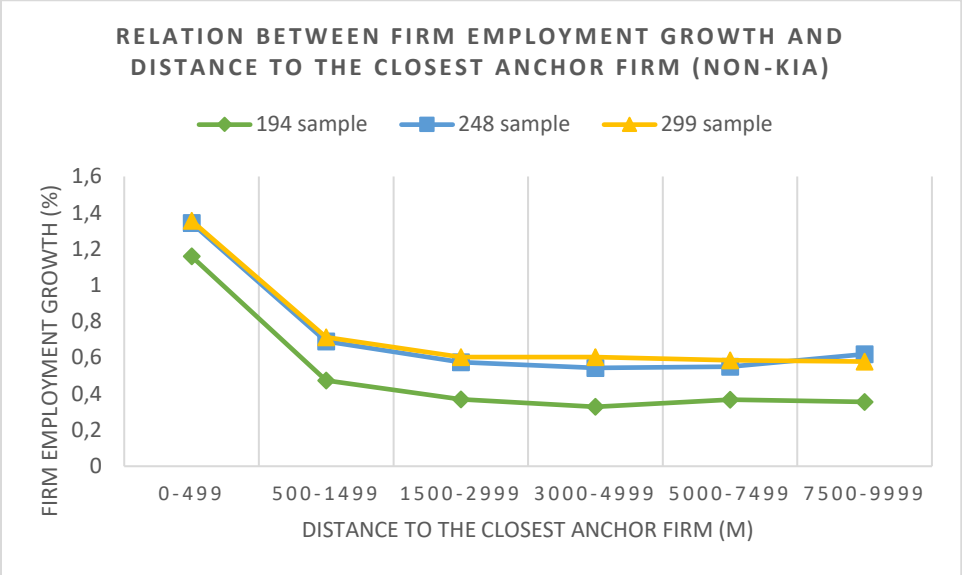
*Cumulative distance of various facilities, exact composition can be found in the methodology chapter.

Appendix 2: descriptive statistics of distance variables (299 sample)

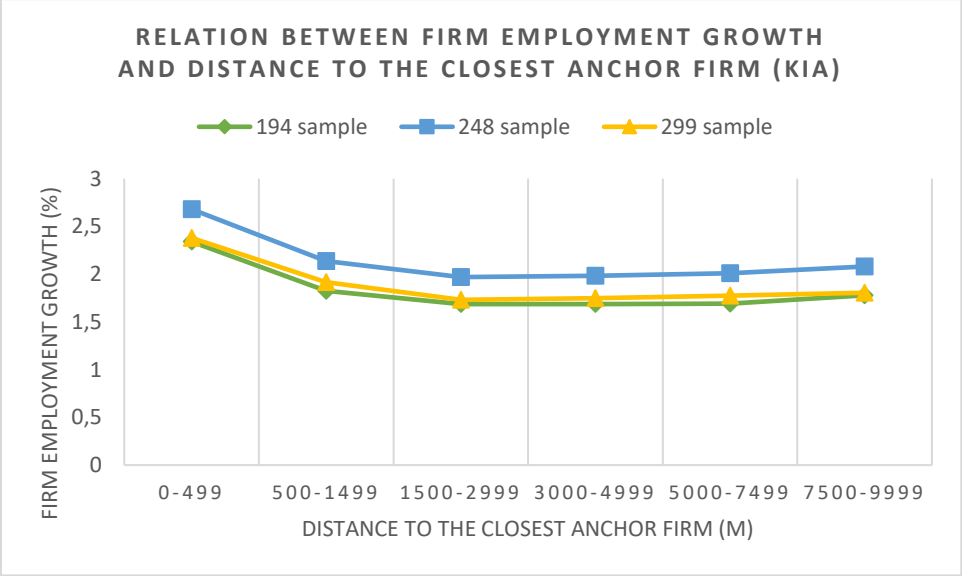
Distance variables in meters (m) - 299 sample	Mean	Std. Dev.	Min.	Max.
Distance to Anchor Firm	1749	2294	0	32849
Extra distance to 2nd Anchor firm	615	1199	0	15077
Distance to University (WO)	15365	15296	0	101189
Distance to University of Applied Sciences (HBO)	11697	11238	0	66823
Distance to Vocational college (MBO)	7939	8239	0	42922
Distance to international airport	28769	19426	0	92402
Distance to train station	4771	5603	400	59000
Distance to Highway	1828	1329	100	46300
Cumulative distance to basic services*	11239	7851	2200	96000
Cumulative distance to recreational services*	44960	28340	7900	267600
Cumulative distance to retail services*	7397	5018	900	48800

*Cumulative distance of various facilities, exact composition can be found in the methodology chapter.

Appendix 3: Relation between firm employment growth and distance to the closest anchor firm (Non-KIA)



Appendix 4: Relation between firm employment growth and distance to the closest anchor firm (KIA)



Appendix 5: Odds Ratios results overview - alternative samples

194 Sample (OR)	0-499m	500-1499m	1500-2999m	3000-4999m	5000-7499m	7500-9999m
General	1,7	1,06	1,03	1,06	1,02	0,97
KIA	1,43	0,91	0,79	0,79	0,77	0,68
Non-KIA	1,81	1,11	1,14	1,19	1,14	1,11
Manufacturing	3,2	2,64	2,57	1,84	1,22	1,59
Low-end Services	1,41	0,79	1	1,15	1,21	1,03
High-end Services	0,65	0,41	0,34	0,31	0,17	0,95
Government & Education	6,37	4,75	3,83	2,44	4,3	3,11
Healthcare	1,58	1,01	0,7	0,87	0,79	0,65

248 Sample (OR)	0-499m	500-1499m	1500-2999m	3000-4999m	5000-7499m	7500-9999m
General	1,68	1,08	1,01	0,94	0,98	0,92
KIA	1,48	0,94	0,73	0,7	0,72	0,55
Non-KIA	1,84	1,25	1,3	1,18	1,19	1,28
Manufacturing	5,01	4,61	3,25	3,3	3,35	1,88
Low-end Services	1,42	0,84	1,25	1,11	1,1	1,27
High-end Services	1,13	0,77	0,63	0,57	0,39	0,72
Government & Education	4,07	2,89	2,22	1,07	0,99	1,35
Healthcare	1,45	0,93	0,62	0,65	0,74	0,64

299 Sample (OR)	0-499m	500-1499m	1500-2999m	3000-4999m	5000-7499m	7500-9999m
General	1,45	0,89	0,86	0,94	0,83	0,96
KIA	1,29	0,79	0,63	0,72	0,58	0,41
Non-KIA	1,56	0,99	1,11	1,13	1,04	1,39
Manufacturing	1,09	0,87	0,81	0,94	0,75	0,64
Low-end Services	2,09	1,14	1,76	1,81	1,54	2,55
High-end Services	1,81	1,11	1,08	0,97	0,32	0,29
Government & Education	14,45	10,57	7,52	5,23	5,95	3,18
Healthcare	1	0,63	0,4	0,49	0,52	0,43

Appendix 6: %-point firm employment growth rates results overview - alternative samples

194 Sample (%-point)	0-499m	500-1499m	1500-2999m	3000-4999m	5000-7499m	7500-9999m
General	1,724	1,112	0,996	0,968	0,99	0,999
KIA	2,34	1,825	1,686	1,686	1,692	1,779
Non-KIA	1,159	0,473	0,369	0,328	0,368	0,355
Manufacturing	1,125	0,582	0,484	0,375	0,324	0,278
Low-end Services	0,538	0,152	0,046	0,019	0,008	0,007
High-end Services	0,706	0,164	0,041	0,014	0,066	0,138
Government & Education	1,38	1,102	1,021	1,119	0,991	1,012
Healthcare	1,127	0,64	0,402	0,551	0,444	0,568

248 Sample (%-point)	0-499m	500-1499m	1500-2999m	3000-4999m	5000-7499m	7500-9999m
General	1,378	0,798	0,661	0,649	0,655	0,717
KIA	2,68	2,138	1,969	1,983	2,01	2,079
Non-KIA	1,343	0,689	0,574	0,543	0,55	0,618
Manufacturing	1,569	1,069	0,993	0,919	0,792	0,858
Low-end Services	0,85	0,199	0,071	0,047	0,118	0,179
High-end Services	0,737	0,23	0,084	0,038	0,105	0,214
Government & Education	1,212	0,989	0,883	0,98	0,936	0,867
Healthcare	1,136	0,641	0,371	0,553	0,502	0,543

299 Sample (%-point)	0-499m	500-1499m	1500-2999m	3000-4999m	5000-7499m	7500-9999m
General	1,362	0,801	0,66	0,673	0,663	0,662
KIA	2,379	1,914	1,731	1,749	1,776	1,805
Non-KIA	1,356	0,712	0,602	0,603	0,585	0,578
Manufacturing	1,317	0,845	0,797	0,724	0,594	0,641
Low-end Services	0,784	0,144	0,02	0,012	0,045	0,02
High-end Services	0,688	0,19	0,036	0,013	0,038	0,09
Government & Education	0,822	0,659	0,496	0,623	0,632	0,531
Healthcare	1,238	0,778	0,529	0,694	0,732	0,694