Title master thesis: Entrepreneurship & Space: the effect of the degree of agglomeration and the innovation climate on the number of business start-ups in municipalities in the Netherlands

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ABSTRACT

This thesis studies the effects of both the degree of agglomeration and the innovation climate on entrepreneurship in the Netherlands on municipal level. Based on a theoretical framework, hypotheses regarding the influence of both determinants on entrepreneurship are derived. A dataset has been constructed containing municipal-level data from 2006. First, the degree of agglomeration per municipality has been determined. This is done by using the model of municipal connectedness, which measures the interdependency between municipalities based on in and out-commuting employees. The model, created by Van Oort (2002), is updated in this thesis using data from 2006. Based on the connectedness, the degree of agglomeration is determined for each municipality. Furthermore, by using several various indicators, the innovation climate per municipality is measured. Finally, as a proxy for entrepreneurship, the number of business start-ups per municipality is used. Using a multiple regression model, the effects of both agglomeration and innovation climate on business start-ups are researched. Furthermore, by including variables for demand and supply factors for entrepreneurship, differences between municipalities with respect to these factors are controlled for. Overall, the results show that the degree of agglomeration in the Netherlands has positive effects on the number of start-ups in a municipality. However, differences with respect to these effects differ between regions in the Netherlands. In the Randstad, agglomeration economies are less relevant compared to the rest of the Netherlands. In this area, characterized by relatively high population density and concentration of urban agglomerations, it is of less importance for entrepreneurs to be located within an agglomeration to benefit from its agglomeration externalities. In the intermediate zone and the periphery, location does appear to be of importance. With respect to the effect of the innovation climate on entrepreneurship, only the presence of micro firms shows a consistent, significant and positive influence on entrepreneurship. As such, there is insufficient evidence to conclude that the innovation climate as a whole has effects on entrepreneurship.

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1. INTRODUCTION

"Entrepreneurship is the engine of economic growth" (Glaeser et al. 1992). However, entrepreneurship or the propensity for it, can vary in space, "not only between countries but even more so between regions" (Pellenbarg & Van Steen 2003). Entrepreneurship appears to be concentrated in some regions while being absent in others (Reynolds et al. 1994). Urbanized regions show higher rates of entrepreneurship compared to less urbanized or rural areas (Pellenbarg & Van Steen 2003).

Urban areas are considered attractive for entrepreneurs due to the presence of agglomeration economies, which can be urbanization and localization externalities (Acs et al. 2008). Both types of externalities comprise the spillover of knowledge. This spillover is especially beneficial to entrepreneurs seeking opportunities. Knowledge is essential in creating the entrepreneurial opportunities for small and new firms (Audretsch & Keilbach 2005). As sufficient (financial) resources for research and development are required, knowledge spillover can be a less expensive alternative when seeking knowledge. As opposed to the costly R&D, knowledge spillovers can be acquired without such high expenses. In order to get access to this knowledge one needs geographical proximity, especially when the knowledge concerned is of an implicit nature. Agglomeration economies, knowledge spillovers included, diminish with distance. Thus, in order to benefit from these externalities, geographical proximity is required.

In addition to agglomerations, knowledge spillovers are likely to occur in innovative surroundings. Thus, in seeking new opportunities to act upon, the entrepreneur might want to find himself in surroundings characterized by high levels of innovation, out of which knowledge can spill over. This highlights the relationship between entrepreneurship, agglomeration and innovation.

This thesis investigates the influence of agglomeration externalities and the innovation climate of municipalities on entrepreneurship in the Netherlands. However, with a relative high level of density and its small geographical size, one may ask himself whether the agglomeration externalities and the innovation climate influence entrepreneurship only in confined agglomerated areas or whether they are spread more evenly over the country. For example, in the Randstad, which is characterized by the highest density in the Netherlands, it could be expected that the externalities are not bounded by borders of agglomeration but reach beyond it. As such it would be of less importance where the entrepreneur is located. However, the opposite could be expected in the peripheral regions of the Netherlands. More generally speaking, does space matter when it comes to entrepreneurship in the Netherlands? This is the main focus of the paper. As such the main research question is as follows:

Does the degree of agglomeration of municipalities in the Netherlands, and the corresponding innovation climate of that municipality, have effects on entrepreneurship (i.e. the number of business start-ups) in that municipality and are these effects different between macro zones in the Netherlands?

In an effort to answer this research question, the following sub questions are proposed, which will be addressed in this paper:

- Does the size of a municipality affect the relative number of business start-ups in the Netherlands?
- What are the degrees of agglomeration and do they affect the number of business start-ups in the Netherlands?
- How do indicators of an innovation climate influence the number of business start-ups in the Netherlands?
- Do the effects of degrees of agglomeration and innovation climate differ for municipalities that are in the Randstad or intermediate zone/periphery?

First, the concepts used are elaborated upon from a theoretical perspective after which a framework is constructed that is used as a basis for this thesis. Based on the theoretical framework, hypotheses are derived that correspond to the proposed sub questions. This is done in chapter 2. Second, to test the hypothesized relations, a dataset is constructed. In chapter 3 the content of this dataset is described as well as the variables used in the analysis. Furthermore, the methodology used empirically is discussed. Third, the empirical results are shown in chapter 4 and are briefly highlighted. Fourth, the obtained results are discussed in chapter 5. By reviewing all hypotheses, it will be determined whether the proposed relationships are found or not. Finally, chapter 6 sums up the main conclusions derived from this thesis.

2. THEORETICAL FRAMEWORK

This chapter describes the theoretical framework that is central in this thesis. First, the concept of entrepreneurship is discussed in paragraph 2.1. Second, the determinants of entrepreneurship are highlighted in paragraph 2.2. These determinants will be further discussed in sub sequential subparagraphs. Third, the framework, which is used as a basis for the research of this topic, is constructed and is based on these determinants and their effects on entrepreneurship. This is done in paragraph 2.3. Fourth, the division of the Netherlands in macro regions is described in paragraph 2.4. Fifth, the literature review discusses the research done in the past en sums up findings relevant to this research in paragraph 2.5. Finally, the hypotheses, which are tested empirically in this paper, are presented in the final paragraph 2.6.

2.1 Entrepreneurship

The following paragraph contains three sections. First, the concept of entrepreneurship in general is introduced. Second, the relevancy of entrepreneurship to the economy is discussed, followed by the regional determinants for entrepreneurship, which are central in this thesis.

Entrepreneurship in general

Entrepreneurship has been a focal point of scientific literature since Cantillon in 1755 introduced the concept and acknowledged the existence of an entrepreneurial function within the economic system (Van Praag 1999). Since its introduction, entrepreneurship has been the topic of research from a variety of disciplines, including anthropology, history, management, psychology, sociology, and economics (Hébert & Link 1989). This wide interest makes it a rich and highly explored phenomenon. The downside of this richness is the lack of a common understanding of what entrepreneurship precisely is (Davidsson 2004).

An overview of definitions is given by Davidsson (2004). Entrepreneurship is defined, for example, as new entry (Lumpkin & Dess, 1996), as the creation of new organizations (Gartner and Carter 2003), and as creation of new enterprise (Low & MacMillan 1988). Stevenson and Jarillo (1990) characterize entrepreneurship as a purposeful activity to initiate, maintain and aggrandize a profit-oriented business. Schumpeter (1934) however, limits the definition to the start-up phase, as he argues that "everyone is an entrepreneur only when he actually carries out new combinations" and looses that character as soon as he has built up his business, when he settles down to running it as other people run their business (Nijkamp 2003). Also, Gartner and Carter (2003) state that entrepreneurial behaviour involves the activities of individuals who are associated with creating new organizations rather than the activities of individuals who are involved with maintaining or changing the operations of ongoing established organizations.

Wiklund (1998), however, defines entrepreneurship as taking advantage of opportunity by novel combinations of resources in ways which have impact on the market. In this respect, Schumpeter (1934) describes entrepreneurship as the introduction of innovation in the economic cycle (in Jarillo 1988). The entrepreneur introduces these innovations in order to act on profit opportunities (Van Praag 1999). Remarkable is that some authors define entrepreneurship as the start-up of a company while others define it as behavioural aspects of the entrepreneur when acting upon opportunities.

There are however, also authors that emphasize that the term entrepreneurship has multiple definitions. Stevenson and Gumpert (1992), for instance, suggest that entrepreneurship can be described as starting and operating new venture on the one hand, but it can be described in terms of being innovative, flexible, dynamic, risk taking, creative, and growth oriented on the other hand.

Sternberg and Wennekers (2005) make a distinction between an occupational and a behavioural notion of entrepreneurship. The occupational notion refers to individuals owning and managing a business for their own account and risk. The practitioners of this notion are called entrepreneurs, self-employed or business owners. A dynamic perspective of this concept focuses on the creation of new businesses, while a static perspective relates to the number of business owners. The behavioural notion of entrepreneurship focuses on entrepreneurial behaviour in the sense of pursuing an economic opportunity. In this case, the entrepreneur can be seen as an innovator or a pioneer. Entrepreneurs in this sense need not be business owners, they may also be 'intrapreneurs' (De Jong & Wennekers 2008).

This distinction is also made by Davidsson (2003) He discusses entrepreneurship both as a societal phenomenon and as a scholarly domain. The former referring to the notion that entrepreneurship consists of the competitive behaviours that drive the market process, while the later focuses on the behaviours undertaken in the processes of discovery and exploitation of ideas for new business ventures. In this case, both notions focus on behaviours, but a distinction can still be made between the start-up of a new business and the competitive behaviour of the entrepreneur.

Concludingly, with regards to the definition of entrepreneurship, a distinction can be made between the creation of new firms and the behaviour of entrepreneurs. The behavioural definition of entrepreneurship can be seen as a qualitative approach at the individual level, focussing on characteristics of entrepreneurs. Contrarily, the definition concerning the creation of new firms has a more quantitative approach. For example, the number of business start-ups can indicate a level of entrepreneurship of an area. It is exactly this latter approach that is used in this thesis.

As the focus of this research is on the differences in the number of business start-ups between municipalities, the quantitative approach is used. To do so, this thesis employs a basic definition for entrepreneurship, namely the creation of new firms. Therefore, in this thesis business start-ups and entrepreneurship are used interchangeably.

Besides these approaches to entrepreneurship, another distinction can be made with regards to the motivations for entrepreneurship, namely opportunity based or necessity based. Opportunity based entrepreneurship is an active choice to start a new enterprise based on the perception that an unexploited or underexploited business opportunity exists (Acs 2006). It represents the voluntary nature of participation (Acs & Varga 2005). Necessity entrepreneurship however, reflects the individual's perception that such actions presented the best option available for employment but not necessarily the preferred option (Acs & Varga 2005).

Besides motivational differences Opportunity and necessity entrepreneurship also differ with respect to growth aspirations. Opportunity entrepreneurs expect their ventures to produce more high growth firms and provide more new jobs (Acs & Varga 2005). When looking at the country level, developing countries generally have a higher prevalence rate for necessity entrepreneurship (Reynolds et al. 2001). With respect to regions within countries, differences in necessity entrepreneurship can be ascribed to differences in the level of unemployment for instance. This will be further elaborated upon in paragraph 2.2.3 section.

Relevancy of entrepreneurship to the economy

There are several reasons why entrepreneurship is an important topic in economics and to the economy in general. To start, Reynolds et al. (1994) suggest that new firms provide new jobs. The authors give a short overview of evidence from a number of different countries. Van Praag and Versloot (2007) found that entrepreneurial firms grow, proportionately, faster than other firms. Moreover, they found that in the long run, entrepreneurial firms create positive externalities leading to more employment, also in other incumbent firms.

Reynolds et al. (1994) further suggest that new firms are involved in a substantial proportion of innovations in the economy. These innovations often lead to the creation of entire industries. More specifically, the entrepreneur can be held responsible for the process of 'creative destruction', as Schumpeter described in his book "the theory of economic development" (Schumpeter 1934). This theory states that within a circular flow of goods and money of a given size in a static context (equilibrium), the entrepreneur disturbs this by implementing new innovations (creativity) and hence replacing existing goods or methods (destruction). Moreover, the driving forces for a change towards a new economic equilibrium is formed by innovation, which means a breakthrough of existing patterns of production and productivity (Nijkamp 2003), thereby implying an important connection between entrepreneurship and innovation.

Furthermore, these innovations provide a major challenge to established firms and encourage them to shape up, by improving their products or services or to reduce their prices (Nijkamp 2003). Even when the products or services provided by the entrepreneur are not radical innovations, their entrance to the market increase competition, and give consumers new choice alternatives (Davidsson 2006), which also encourages incumbents firms in a similar way.

Finally, Reynolds et al. (1994) suggest that new firms can lead to economic prosperity. Successful new enterprises in a geographical area contribute significantly to the economy and employment in the region concerned (Nijkamp 2003). Furthermore, this prosperity can attract additional entrepreneurs, by providing new opportunities. Although not all regions with high rates of new firm formation prosper, it is rare for regions that prosper not to have high firm birth rates.

Through the creation of employment, the implementation of innovations and the creation of economic prosperity, new firms have a strong impact on a regions' economy. Therefore it might be interesting to find out what causes entrepreneurship and what determines the number of start-ups in a region.

Regional determinants of entrepreneurship

A great proportion of regional variation in business start-ups can be explained by appreciating the specific characteristics of different regions (Bosma et al. 2008a). In their paper, Bosma et al. (2008a) have constructed a framework which, based on their finding in the literature, state what determines new firm formation. To start, Bosma et al. (2008a) suggest that positive externalities, that derive from agglomerations influence new firm formation. Reynolds et al. (1994) also highlight the positive effects of agglomeration externalities on business start-ups. Furthermore, the framework of Bosma et al. (2008a) highlights the influence of demand and supply factors for entrepreneurship on the number of business start-ups in a region. Consequently, they argue, when demand or supply is high, the rate of entrepreneurship in that region is likely to increase. The third and final determinant in their framework is the effect of environment policy and culture on new firm formation. Even though, these determinants are likely to be of influence, these determinants are of a more qualitative nature and therefore difficult to measure. Moreover, the current study incorporates these first two discussed determinants of entrepreneurship, namely agglomeration and demand and supply factors to investigate their effects on differences in regional entrepreneurship.

Furthermore, as Schumpeter (1934) suggested the entrepreneurial function is that of creating new combinations with existing resources. This function, as he argues, can be defined as innovation. This suggests that entrepreneurship is a means by which innovations come fourth. Acs and Varga (2005) argue that technological change is an important source of entrepreneurial opportunity, because it makes it possible for people to allocate resources in different and potentially more productive ways. Concludingly, one could expect high rates of entrepreneurship in areas characterized by high levels of innovation or in other words areas with a relative developed and high innovation climate. Thus, in addition to the above mentioned determinants of entrepreneurship, namely agglomeration and demand and supply factors of entrepreneurship, this thesis also researches the influence an innovation climate has on entrepreneurship.

2.2 Determinants of entrepreneurship

This paragraph focuses on the regional determinants of entrepreneurship as discussed in the previous paragraph. Demand and supply for entrepreneurship, agglomeration and innovation climate are consecutively discussed in the next subparagraphs.

2.2.1 Demand and supply factors for entrepreneurship

The number of business start-ups in a region often depends upon the demand and supply for entrepreneurship in that region. New businesses generally focus on local markets. Regional consumer demands can therefore be of great importance for the demand for entrepreneurship (Bosma et al. 2008a). As demand increases, opportunity based entrepreneurship is stimulated, thus new firms are likely to establish in order to satisfy this increased demand (Reynolds et al. 1994). In addition, local supply factors further shape the number of business start-ups in that region (Audretsch & Fritsch 1994).

Both population density and population size have an effect on the demand for entrepreneurship. Population density has been connected to urbanization economies (Reynolds et al. 1994; Glaeser & Mare 2001). However, it also makes it easier to reach consumers (Krugman 1991). When population density is high, more potential customers live in close vicinity, therefore increasing potential demand. In addition, high diversity of a population leads to a greater variety of demand for products and services (Bosma et al. 2008a), thus creating opportunities for the emergence of niche markets. A large urban population often consists of greater diversity, stimulating the emergence of niche markets and ultimately entrepreneurship.

Population growth is a straightforward estimator for local demand, as the population increases, demand of goods and services will subsequently increase. Armington and Acs (2002) found a significant and positive effect of population growth on firm formation.

Another factor that influences local demand is income (Bosma et al. 2008a). As income increases, consumers are able to increase their spending and thus, demand for products and services increases. As such, income influences the demand for entrepreneurship. It also affects (both positive and negative) the supply of entrepreneurship. As income, or regional wealth, increases, potential entrants can obtain greater access to capital (Reynolds et al. 1994). This has a positive effect on the supply of entrepreneurs. This effect is also found by De Clercq et al. (2007). An increase in income however, also increases the opportunity costs for starting a new business (Bosma et al. 2008a) which reduces the supply of entrepreneurs.

Similar to the increase in income, changes in unemployment can both influence the demand and the supply for entrepreneurship. It is however difficult to predict the effect of increased levels of unemployment on the number of business start-ups. A number of studies found a positive effect of unemployment on firm formation while other studies found the opposite effect (Audretsch & Jin 1994).

An increase in unemployment can, for instance, increase the supply for (necessity) entrepreneurship because more people may be pushed into self-employment (Reynolds et al. 1994). The supply of (opportunity) entrepreneurship is likely to decrease however, because of increased opportunity costs for starting a firm. Nascent entrepreneurs who still have a job postpone their actions towards self-employment. Furthermore, Creigh et al. (1986) suggest that depressed conditions that are associated with regional unemployment imply that the conditions are not ideal for entrepreneurial activity. The depressed circumstances lead to lower levels of spending power and hence lower levels of demand. The effect of the loss of demand can cancel out any 'push' effects of unemployment.

Furthermore, ethnic background can also be of influence on the entrepreneurial decision. Thus, without elaborating too much on personal characteristics of ethnic minorities, it is often found that minority populations have a higher percentage of self-employment. Brooksbank (2000) for instance, found significant differences in the self-employment rate between populations with different ethnic background. For the Netherlands, Kloosterman and Rath (2000) found that the percentage of self-employed immigrants of the corresponding labour force more than doubled in recent years. Moreover, they found that this percentage for some ethnic groups is significantly higher than for the percentage for the entire population. A population with many ethnic minorities may thus be related to a high number of new and young firms. (Bosma et al. 2008b).
Ethnic minorities in the UK for example, tend to be concentrated in distinct geographical locations (Brooksbank 2000). Moreover, in many western countries, immigrants are heavily concentrated in the core areas of urban centres, encouraging the number of small firms in these urban areas (Aldrich & Waldinger 1990). These findings suggest, that the presence of ethnic minorities not only potentially influence the number of business start-ups, they could also influence the possible findings with respect to business start-ups in urban core areas. The presence of ethnic minorities should therefore be included in the analysis.

Although some influences of demand and supply are pretty straightforward, others are more difficult to determine. All mentioned factors should however be included in the empirical research as they are likely to differ across regions and are expected to affect the number of business start-ups.

2.2.2 Agglomeration

In basic terms, agglomeration refers to the concentration of people or (economic) activities. However, when agglomeration is referred to, often a city or metropolitan area is meant. This thesis is focused on agglomeration of municipalities and its effect entrepreneurship. This paragraph discusses the concept of agglomeration of cities and connects it to entrepreneurship.

For example, with respect to the Netherlands, the concentration of economic activity in space is striking. Since 2002, urban areas in the Netherlands inhabit more residents than rural areas, and the absolute increase of residents is the highest in the provinces of North- and South-Holland, where the percentage of inhabitants of urban areas is already the highest. In 2004, 66 out of 100 residents of South-Holland live in urban area, compared to 7 out of 100 in Drenthe (CBS 2005). The Randstad occupies 20 percent of the land area of the Netherlands, while it inhabits approximately half of the Dutch population (Nijmeijer 2000). Rosenthal and Strange (2004) suggest that for any developed country, both labour and capital are heavily concentrated in cities. Furthermore, they suggest that individual industries are concentrated too.

This clustering of activities however, increases competition for land. In order to maintain real wages, increases in nominal local wages are required. The increased labour and land prices reduce the profitability of local firms, making it less attractive for firms to cluster. Unless, however, there are benefits associated with clustering compensating this reduction of profitability (McCann 2008). The clustering of economic activity therefore suggests the existence of place specific economies of scale, or positive externalities of agglomeration (agglomeration economies).

Agglomeration economies are independent of a single firm, but can be accrued to all the firms located in the same area. These economies raise the return to a particular firm located in a region as a result of the location to other firms in the same region (Bresnahan et al. 2001).

A common distinction made, with respect to agglomeration economies, is between localization and urbanization economies. The former refers to externalities arising from concentration of economic actors within the same industry. The latter, in contrast, refers to externalities arising from the concentration of people and firms in urban areas and as such, does not focus on industries. Moreover, it presumes diversity of industry and considers it as its main advantage. These two types of agglomeration economies will now be further elaborated upon.

Localization economies

Localization economies were introduced by Marshall in 1890. He suggested that the sources of these economies are labour market pooling, linkages between intermediate- and final-goods suppliers, but even more so knowledge spillovers (Duranton & Puga 2004).

Knowledge spillovers allow firms to acquire knowledge from other economic players without having to pay for it in a formal market transaction (De Clercq et al. 2007). These spillovers can be characterised an agglomeration economy because information flows more easily locally than over greater distances (Krugman 1991). Proximity is especially beneficial in the transfer of tacit knowledge. This type of knowledge is difficult to codify and therefore requires face to face interaction when transferred. When firms of a single industry are co-located in the same area, they enjoy the spillovers of knowledge of other firms. Means by which knowledge spills over are for example, social contacts with employees of other firms, labour mobility and reversed engineering. Marshall (1920) describes this phenomenon as follows: "when firms are co-located, the mysteries of trade become no mystery, but are as it were in the air". Furthermore, he suggests that when new ideas arise or innovations are implemented, others take notice and combine this information with suggestions of their own, therefore, this knowledge becomes the source for further new ideas (Krugman 1991). Because these firms are operating in the same industry, they have a higher absorption capacity of information concerning this industry, and hence they are better able to understand and use the obtained knowledge.

Additional economies of agglomeration can occur due to labour pooling. When a number of firms in an industry are clustered in the same place, an industrial centre arises, which allows for a pooled market for workers with specialized skills. A localized industry gains a great advantage from the fact that it offers a constant market for skill (Marshall 1920). Employers are inclined to establish their firm in a place where they are more likely to find suitable workers with the special skills they require. On the other hand, job searchers are likely to go to places where there are plenty of employers looking for the specialized skills that they posses. Agglomeration, therefore, allows for a better match between an employer's needs and a worker's skills and reduces risk for both (Rosenthal & Strange 2004). The pooled labour market benefits both firms and workers.

The third externality arising from agglomeration is specialization. The presence of a large number of firms in the same industry can offer opportunities for subsidiary trade. Due to the presence of a large number of buyers, mass production offers scale economies. According to Marshall, in a district in which there is a large production of the same kind, expensive machinery, which otherwise could not be attained, can be used as a result of scale advantages (Krugman 1991). Thus, firms can now focus on a small part of the production-process. This results in a specialized inputs market where firms can share inputs of which the production involves increasing returns to scale. In this way, incumbent firms benefit from cost reductions.

Urbanization economies

In contrast to Marshall's localization economies that arise from the concentration of a single industry, urbanization economies are not industry specific. These externalities occur in large urban and, in particular, in metropolitan regions. These areas are characterised by a large and diversified population living in high density. Furthermore, there is a variety of economic activity and a range of different industries.

The importance of urban diversity for innovation and economic growth was already observed by Jacobs (1969). She argues that the most important source of knowledge spillovers is external to the industry in which the firm operates. Cities are considerable incubators for innovation because of the great diversity of industries and therefore a great source of knowledge (Audretsch & Feldman 2003). Jacobs suggests that this diversity fosters cross-fertilization of ideas. When firms of a certain industry notice how other industries operate, they can find solutions for their problems or inspiration for innovation. A variety of industries within a geographic region promotes knowledge externalities and thus innovation activity.

Karlsson and Petersson (2005) offer an overview of other benefits of regions with high economic density. These regions offer opportunities for specialisation on several grounds. Specialisation of infrastructure makes it easier to transport goods and information, and at lower cost. Specialisation in input provision results in a higher degree of diversification of input provision. It is more likely that the exact inputs a firm needs are present in this region. Also, specialisation and diversification can reduce the input cost.

Alongside the positive externalities that arise from urbanization as well as localization, negative externalities can occur. These negative externalities however, mainly occur in regions characterized by high population density and population size (Duranton & Puga 2000). Examples of such diseconomies of agglomeration are pollution, congestion or increased wages (Bosma et al. 2008a). Furthermore, the crime rate often increases with the size of an urban area (Glaeser & Mare 2001). The presence of these diseconomies make urbanized areas more expensive and less attractive. When the density of urban areas increases, the diseconomies of agglomeration eventually outweigh the economies, rendering an area unattractive to new firms. Bosma et al. (2008a), however, found that most studies report that the positive effects of agglomeration often outweigh the negative effects. Thus, the current study does not incorporate such negative effects in the model as such. However, some of the demand and supply factors described in the previous paragraph encompass some of these elements.

Agglomeration economies and entrepreneurship

According to Acs et al. (2008), agglomeration effects are the main argument why urbanized areas should have a higher rate of business start-ups compared to non-urban areas, irrespective of whether these effects are urbanization or localization externalities. With this statement, Acs et al. (2008) suggest that both types of externalities appear in urbanized areas. Furthermore they imply that besides urbanization externalities, localization externalities are more likely to appear in urbanized areas than in non-urban areas. The presence of firms of the same industry in an urban area, and the resulting

externalities, may be an additional aspect that makes the establishment of a new firm in this urban area more attractive.
As localization economies are externalities associated with spatial concentration of firms of the same industry, and the dataset used for the current study does not include industry data, it is difficult to include these externalities in the empirical model and test for their presence and influences on entrepreneurship. However, for the above mentioned reasons, these economies and their effects on entrepreneurship are included in this section.

Localization economies are beneficial for most economic actors in a certain region, but they are particularly important for start-ups (Bosma et al. 2008a). Entrepreneurs can derive many opportunities from these economies.

To start, the large pool of skilled workers reduce risk and make it more likely to find employees with the required skills. Rosenthal and Strange (2005) found that the amount of local employment of the entrepreneur's own industry in an urban area has positive effects on business start-ups. They also found evidence that this effect attenuates with distance.

Furthermore, the externality of specialisation offers many opportunities for the production of non-traded subsidiary products. It is likely that these entrepreneurs recognise these opportunities and implement the associated products. Reynolds et al. (1994) found evidence that regions which are characterized by a high proportion of small firms and specialization, indeed, have a higher number of business start-ups. Harhoff (1999) however, found that regional specialization has an initially increasing, positive effect on firm formation. For high degrees of specialization, however, he found that effect to be decreasing.

Finally, the spillover of knowledge may prove especially valuable for starting businesses. Research and development generally require a substantial amount of resources. Starting firms often do not possess these resources, it therefore can be a huge burden for starting firms to acquire the required knowledge. As knowledge spillovers allow firms to acquire knowledge from other economic players without having to pay for it in a formal market transaction (Acs et al. 1994 in: De Clercq et al. 2007), it is especially beneficial for starting firms. They can compensate for their lack of research and development through the externalities of knowledge spillovers (Audretsch & Feldman 2003).

A typical form of knowledge spillover is the spin-off firm. Entrepreneurs use knowledge created in incumbent firms, that might otherwise have remained unused or dormant, and use this knowledge to start up a new firm (Audretsch & Thurik 2008). This knowledge may not be of use for the incumbent firm if it does not make good use of the firms' existing resources and capabilities, or the new initiatives address a small niche-market (Davidsson 2006). In this case, the knowledge is discovered within the boundaries of an incumbent firm, but exploited by the entrepreneur in a spin-off firm. As such, entrepreneurship serves as an important mechanism for the spillover of knowledge as well (Audretsch & Thurik 2008). This type of (knowledge spillover) entrepreneurship usually tends to be spatially located within close proximity of the source of that knowledge (Audretsch & Aldridge 2008). In the latter case, entrepreneurs decide to remain in the location they already inhabit. It is therefore difficult to determine whether entrepreneurs move to a location because of its externalities, or that inhabitants decide to become an entrepreneur because they discover new opportunities while they were located in that area. Marshalls' localization externalities however, do provide substantial benefits for new businesses and thus stimulate entrepreneurship.

In addition to localization economies, urbanization economies provide substantial benefits to entrepreneurs, making urban areas incubators for new firms (Reynolds et al. 1994). Due to these agglomeration economies, urban areas are expected to have a higher rate of business start-ups (Acs et al. 2008). Leone and Struyk (1976) stated that small manufacturing start-ups find it to their comparative advantage to locate within centralized urban areas. Van Oort and Atzema (2004) extended this "incubator hypothesis" to all new firms. They further found empirical support for this for firms in the ICT sector.

The urbanization externalities arise with the density and diversity of urban regions. To start, the knowledge spillovers associated with urbanization (Jacobs 1969) arise with diversity and are enhanced by competition (Audretsch 2003). Greater competition across firms, together with the presence of highly sophisticated markets, stimulate new ideas and the exploitation of niche markets (Audretsch 2003).

Then, the density of urban areas, combined with a large and diversified population, provide great access to customers, as well as inputs required for the production of goods or services (Reynolds et al. 1994). Additionally, urban areas virtually guarantee starting firms a qualified work force, access to networks of physical or informational infrastructures and the required risk-capital (Rotefoss & Kolvereid 2005).

In addition, urban regions are generally associated with higher relative population growth which further increases the access to consumers. Population growth is found to positively influence the number of business start-ups (Armington & Acs 2002).

Besides the access to consumers and resources, urban areas also enhance the demand and supply factors for entrepreneurship. Population growth and density are two factors influencing this demand and supply (Reynolds et al. 1994). Furthermore, urban areas are attractive to younger and highly educated people, which increase the pool of potential entrepreneurs Rotefoss & Kolvereid (2005).

For the Netherlands, Bosma et al. (2008a) found that the degree of urbanization of Dutch COROP-areas has a positive and significant influence on new subsidiaries. The COROP-classification is comparable to a disposition in agglomerations, as there is a central and its service area. Bosma et al. (2008a) found no significant relationship between the degree of urbanization and independent start-ups. The benefits associated with the location in dense areas thus seem to influence the location decision for new subsidiaries, but not for entrepreneurs. This result suggests that entrepreneurs are more likely to be bounded by the environment of residency, while subsidiary firms can choose any location beneficial to the firm.

The authors did find a significant positive relationship between the degree of urbanization of a COROP-area for both subsidiary and independent manufacturing start-ups. This result suggests that urbanization economies are more beneficial to manufacturing firms that firms operating in the services industry.

The paper shows similarities with the research that is central in this thesis. However, degree of agglomeration used by Bosma et al. (2008a) is, as mentioned, based on a COROP level, instead of municipal level (in this thesis). A COROP consists of a central core and its service area. However, what makes the COROP classification difficult to interpret, with respect to agglomeration, is the size of some COROP's and the chosen borders. For example, the entire province of Flevoland is chosen as a COROP. However, an agglomeration could well be present in two or three COROPS, not bounded by the border of the COROP itself. Even though the results provide valuable information, the classification in COROP areas in this research is too broad. As such, the degree of agglomeration in this thesis is determined per municipality.

Agglomeration in the Netherlands

In this thesis, there are two ways in which the degree of agglomeration is considered for the Netherlands. The first is a division based on city size. As such, all municipalities are divided into one of three categories, being "G4", "G27 and "non-g". The G4 consists of the four largest Dutch cities, the G27 consists of the twenty seven subsequent large cities, and non-g is the category which comprises of the municipalities not included in either G4 or G27 and thus forms the rest category. The G4 is characterized by the highest degree of agglomeration, followed by the G27 and the rest (non-g). Based on this classification, one can determine the degree of agglomeration for each municipality, by determining in which category they belong. However, by using this method in determining a municipal's degree of agglomeration, one does not incorporate the interdependency between municipalities, but rather assesses each municipality separately based purely on city size. Especially in a country like the Netherlands with a high population density, municipalities can be located close together. Less urbanized municipalities can benefit from nearby located municipalities with high density of population size, and therefore benefit of the agglomeration economies of that larger municipality. Nonetheless, this classification is good first indicator for the presence of agglomeration economies and is therefore also researched empirically.

The second method used to determine a municipal's degree of agglomeration is based on a model constructed by Van Oort (2002), namely the connectedness spatial regime. This connectedness spatial regime is based on the number of in and out-commuting workers on a daily basis between municipalities and thus measures interdependency between municipalities. Van Oort (2002) specifies four types of connectedness, namely 'core', 'suburban', 'dependent' and 'autonomous' (of which core is the highest and autonomous is the lowest degree of agglomeration). Based on the in and out-commuting data the connectedness of a municipality is determined. To be labelled as a core area, at least 15,000 workers have to commute from outside municipalities to this core municipality, on a daily basis. Suburban areas are dependent on core areas for employment. Thus, if twenty percent of municipal's labour force commutes to a nearby core region on a daily basis it labelled as suburban. Within the rest group, Van Oort (2003) further distinguishes between dependent and autonomous municipalities, based on a location quotient. However, the data used in the model by Van Oort, dates back to the 1990s. To make use of this classification, it is valuable to update the model, using more recent data. As such, using data from 2006, the degree of connectedness has been recalculated and 'core' and 'suburban' regions have been identified. Furthermore, the remaining municipalities have been grouped together to form the group 'rural'. The results of this are discussed in chapter 4.1.

The Randstad area comprises of the four largest cities in the Netherlands, namely Amsterdam, Rotterdam, The Hague and Utrecht as well as several medium size cities. This area belongs to the most congested European regions, before the Ruhr area, Germany and Paris, France (Broersma & Van Dijk 2008). Broersma and Van Dijk (2008) as well as Frenken et al. (2005) suggest a presence of diseconomies of agglomeration in the densely populated area of the Randstad, whereas less dense areas in the periphery, on the other hand, provide economies of agglomeration. Therefore, with these characteristics differences can be expected in different regions within the Netherlands. To control for this, the research in this paper, also considers these different regions in the Netherlands separately by diving the Netherlands in macro zones (Van Oort 2002). This division is shown in paragraph 2.4.

2.2.3 Innovation climate

In terms of agglomeration economies, knowledge spillovers are considered as one of the main positive externalities of agglomeration, as discussed in the above paragraph. Perhaps, agglomerations are a 'place to be', at which 'everything happens'. The occurrence of knowledge spillovers can be attractive to entrepreneurs as opportunities deriving from them can be a basis for setting up a new business. Apparently, there are enough urban increasing returns to compensate the burden of being surrounded by competitors. However, in competing with one and another, firms are not competing at price level anymore, but rather it seems that innovation nowadays is used as a "main battle weapon with which they protect themselves from competitors and with which they seek to beat those competitors out" (Baumol 2002; Schilling 2006). Therefore, one might expect a considerable amount of innovation within an agglomerated area, or in other words the presence of an innovation climate. Such an innovation climate can draw entrepreneurs by providing opportunities, but also by providing a tool to compete with one another. It is exactly this innovation climate that is a second main focus of the theoretical framework used in this paper. First, innovation in general is discussed, and its relationship to technological progress and knowledge. Secondly, the innovation climate will be elaborate upon. Finally, the link to agglomeration is made to fit in the framework as proposed in the end of this chapter.

Innovation in general

Traditionally, economic growth can be attained, by increasing the productivity. Alongside labour productivity and capital intensity, technological progress is one of the main influences to economic growth. Neo-classical economic growth models[1] incorporated this, however they failed to explain the rapid economic growth witnessed in the last two centuries (Sørensen & Whitta-Jacobsen 2005). The early growth models treated technological change exogenously. In the 1980's and 1990's economists, in particular Paul Römer, succeeded to incorporate technological progress endogenously in their growth model and developed the model of endogenous growth (Römer 1990). This model incorporates the positive effects of the size of the economy, the savings rate and the productivity of workers in the research sector. These are introduced as the main influence factors behind the stock of knowledge and thus the technological progression, which in turn fuels economic growth. This model was more accurately capable of explaining the rapid economic growth after the industrial revolution. Nonetheless, both the early exogenous, and the later developed, endogenous growth model stress the importance of technological progress to economic growth.

Technology in this sense refers to the goods and services produced and the means by which they are produced in a firm, an industry or economy (Stoneman 2003). In its purest form, technology is knowledge to pursue goals and to solve problems (Simon 1973). The application of new knowledge in this respect highlights the most important distinction between invention and innovation. As such, the generation of new knowledge by itself can be considered as invention, whereas the application of this knowledge is required to transform an invention into an innovation. Therefore, one could speak of innovation when new knowledge is generated and applied in solving practical problems. In this paper innovation is considered, as did Joseph Schumpeter (1934): referring to the whole innovation process, from the birth of a new technological idea to the introduction to the market of the resulting novel product or procedure (Baumol 2002). Schumpeter defined innovation as the new combination of

[1] This became known as the Solow growth model.

existing resources, and labelled this activity as the entrepreneurial function (Fagerberg 2005). According to Schumpeter five different cases are possible, namely the introduction of a new good (product innovation), a new method or procedure (process innovation), the opening of a new market, the opening of a new source of supply and the carrying out of the new organization of an industry, e.g. like the creation or breach of a monopoly position (Fagerberg 2005). An example of such a breach is the operating system software of Linux and Apple, which significantly gained market share and reduced Microsoft's dominant position in this market. However, the definition of innovation does not seem to be so straightforward, as some regard different dimensions of innovation than others do. Schumpeter, for example, restricts his analysis to radical innovations. This means that the innovation at hand is significantly different from anything else that is on the market, replacing older technologies and making them obsolete (creative destruction). However, some innovations are not radical, but rather of an incremental nature. Some authors even argue that the incremental innovations have just as great (or even greater) cumulative economic impact, and therefore to ignoring these, leads to a biased view of long run economic and social change (Fagerberg 2005).

Additionally, another important aspect of the definition of innovation is its subjective dimension. Moreover, if one looks at the definitions of innovation, these often include the word 'new' and thus one could ask himself: "new to whom?". So, does an innovation need to be new to the world or new to a certain country or industry or only new to a firm to be considered an innovation? Also, can a differentiation of a certain product, for example, introduced in another (new) market, be labelled an innovation? The latter might even be a form of imitation, however, this new product is now introduced in a new market, which is considered a form of innovation according to Schumpeter (1934). On the other hand, Schumpeter (1934) argues that these imitators cannot be considered as innovators. Concludingly, this thesis does not distinguish between incremental or radical innovations as they all contribute to an innovation climate.

Innovation climate

There are different ways to measure innovation in order to investigate the effects innovation has on the level of entrepreneurship,. However, due to the properties of innovation, as discussed above (radicalness, product/process dimension and subjectiveness), there might be difficulties in measuring such a concept (Smith 2005), especially in a cross sectional study (such as the current). As not everyone interprets progression as innovations and some might not include incremental or process innovations, different measures might be used. Furthermore, it might prove to be difficult to collect innovation data from all firms within a population. There are however, a few ways to measure innovation.

One way, for example, is to measure inputs of innovation by reviewing the research and development (R&D) expenditures of a firm or region (Smith 2005). However, R&D is neither a sufficient nor a necessary condition for innovation (let alone the availability of data per entity that is researched). Furthermore, R&D is mainly done within larger companies, thus this would exclude (non R&D based) innovations by small firms (Smith 2005).

Another way to indicate innovation is to inventorise the number of issued patents. Limitations to this approach are that not all innovations are patented. Moreover, they are an indicator for invention and thus not for innovation (Smith 2005). Next to these traditional input and output indicators, innovation can be measured by means of questionnaires. However, a disadvantage here is again the subjective perspective.

This thesis investigates entrepreneurship per municipality, whether or not being part of an agglomeration. In an approach to circumvent the difficulties of measuring innovation this thesis focuses on the innovation climate, or in other words look at the basis and surroundings for innovation. In estimating a region's innovation climate, one could look at various indicators, e.g. the proportion of highly educated labour force by viewing them as a potential pool out of which innovation could emerge but also to the number of small firms present.

In a society in which consumers nowadays have diversified tastes and demands and consumer markets are more turbulent than ever before it seems more difficult to gain and sustain competitive advantages by scale or scope (Greene & Mole 2006). Large firms can create scale and scope advantages, and may well have more funds available to conduct R&D. However, small firms are more flexible in adapting to changing demands and linking them to products and innovations. Moreover, empirical studies by Scherer (1980) and the Small Business Administration (Acs & Audretsch 1990) have shown that numerous well-known innovations (both radical and incremental) came from small firms. Therefore, small firms are considered highly important with regards to technological progress, or more specifically to innovation or as Baumol argues: "one can offer the plausible conjecture that most of the revolutionary new ideas of the past two centuries have been, and are likely to continue to be, provided more heavily by independent innovators who, essentially, operate small business enterprises" (Baumol 2002). With entrepreneurs at the heart of new and small firms, this stresses the important role of entrepreneurs in stimulating economic growth. Notwithstanding, the opportunities that arise deriving from diversified consumer tastes at which entrepreneurs can plunge into. The presence of small firms can indicate a certain climate of innovation and attract additional new firms. Reynolds et al. (1994) imply that the presence of small firms and specialization have positive effects on entrepreneurship. Both small firms and specialization create an innovative climate in the concerning area.

Furthermore, one could the presence of universities in a region as an indication for the innovation climate.

Empirically, however, research on innovation clime is subject to the availability of data. As such, the indicators for an innovation climate, that are used empirically, are described in the next chapter.

Innovation, agglomeration and entrepreneurship

One of the main agglomeration externalities (or economies) is knowledge spillovers, as discussed earlier. Knowledge spillover is defined as the transfer of knowledge from one entity to another in which the receiving entity does not pay a corresponding price for receiving it, hence it spills over (Schilling 2006). The creation of knowledge can therefore create positive externalities to others. With knowledge as the basis for the spillover, it is important to make a distinction between tacit and explicit knowledge. Explicit or codified knowledge is relatively easy to communicate and can be written down and interpreted by others without too much explanation, e.g. a manual of a television. Tacit knowledge on the other hand, is referred to as more technological, which is highly contextual, hardly codified and difficult to articulate through language (Boschma 2005). Also, this type of knowledge concerns more know-how, which is embedded in companies or people and is not easily transmitted from one person to the other. As long as knowledge, necessary for innovation, is codified, the access to it is not constraint by spatial distance (Acs & Varga 2005). For the transmission of tacit knowledge, spatial proximity appears to be critical (Acs & Varga 2005). When knowledge is tacit, geographical proximity to the knowledge source significantly amplifies spillovers between research and innovating firms. Thus, when knowledge is not easily codifiable, transfer (or spillover) needs close proximity.

In comparison to codified knowledge (which can be transmitted for example via email), tacit knowledge needs close and repeated face to face interactions. Regarding geographical proximity, Boschma (2005) states that short distances bring people together, favour information contacts and facilitate the exchange of tacit knowledge. In other words being located near each other increases the intensity of these positive externalities as discussed earlier in the effects of agglomeration. Therefore, one might expect these knowledge transfers to be present in agglomerated areas. These areas could therefore be seen as an innovation environment where knowledge is transferred and spilled over. Thus, the agglomeration facilitates knowledge spillovers and can be considered as an incubator for innovation (Acs & Varga 2005). These agglomeration externalities facilitate innovation and may therefore be a more favoured surrounding for entrepreneurs as opposed to less agglomerated areas. With a higher likeliness of coming across new ideas and new knowledge, this can attract entrepreneurs and could boost business start-ups in these areas.

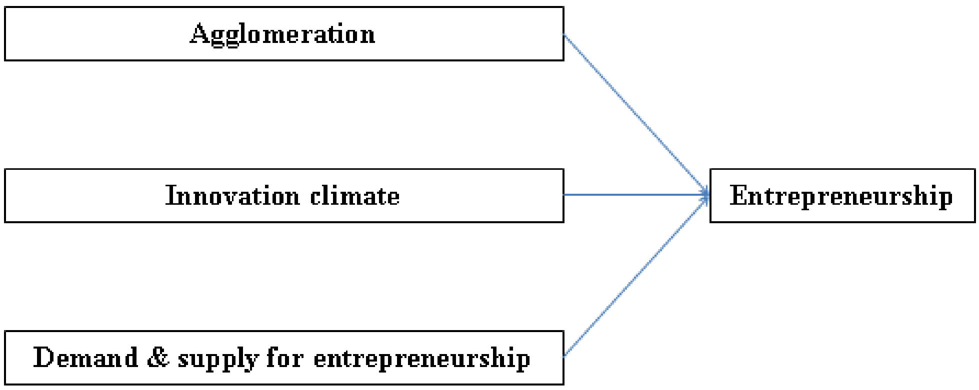
Concludingly, for innovation to happen, input is needed. Research and development, but also the spillovers arising from them are considered important inputs. The highly contextual property of the knowledge that is spilled over makes it easier when there is close proximity. Therefore, agglomerated areas are expected to have advantages for companies in acquiring new knowledge and ultimately coming up with new innovations. Furthermore, the advantages of an agglomeration can be a reason for (nascent) entrepreneurs to move to these areas because of its agglomeration economies.

2.3 Framework

The main topic of this paper concerns the regional differences in entrepreneurship. The determinants used in the current study are elaborated upon in the previous paragraph. This paragraph merges these determinants and their relationship with respect to entrepreneurship, to a single framework (figure 1) that is central in this study. This paper researches the influences of these determinants on entrepreneurship.

On the left hand side of the framework the determinants of entrepreneurship are found. Next to agglomeration (or more specifically the degree of agglomeration) and the innovation climate, demand and supply for entrepreneurship is investigated. Although these demand and supply factors are not the main focus of attention of this paper, they are included to control for differences in entrepreneurship, not explained by agglomeration and innovation climate.

Figure 1: framework of determinants for entrepreneurship



Furthermore, the determinants that are included in the framework are likely to influence one another as described in the theoretical section above. However, the effects of these inter-relationships cannot be distinguished in the empirical results. As such, they are not included in the framework.

With respect to the relationship between the determinants and entrepreneurship it is difficult to conclude on causal relationship, only correlations can be predicted. Nonetheless, to make the framework clear and simple, one directional arrows are included.

2.4 Macro zones in the Netherlands

As the literature suggests, the agglomeration externalities are expected to be higher in dense and urban areas, as opposed to more rural regions. The Netherlands is known for its small geographical size but relative high population density (European Commission 2009). However, even though the country as a whole has a high density, deviations are found between different national zones. Therefore, in this respect distinction between different zones in the Netherlands, with respect to the research topic, might show a better insight.

A common chosen classification (Dieperink & Nijkamp 1986; Van Oort 2002) of zones in the Netherlands divides the country in to three parts, namely the Randstad, the intermediate zone and the national periphery. The Randstad region is characterized as a highly condensed urbanized area, the national periphery on the other hand, consists of more rural areas, leaving the intermediate zone somewhere in between. Half of the Dutch population lives in the Randstad, which covers only twenty percent of the Dutch surface (Nijmeijer 2000). Furthermore, the Randstad comprises of the four largest urban agglomerations[2]. Due to the high density, any municipality within the Randstad area is presumably either part of, or lies in the vicinity of an urban agglomeration. With this property it might even be so that in the Randstad zone the degree of agglomeration of a municipality is of lesser influence on the locational decision of entrepreneurs. Irrespective of their location, entrepreneurs in the Randstad could benefit from agglomeration economies. The periphery comprises of the provinces with the lowest population density, i.a. Zeeland, Limburg, Friesland, Groningen en Drenthe. In this macro zone, the number of agglomerations is lower and they are more geographically spread. Agglomeration economies therefore, are more concentrated in the agglomeration. As such, it could have an influence on the locational choice of the entrepreneur.

In dividing the Netherlands in such regions, Van Oort (2002) constructed a gravity model of employment, which measures the potential number of employees over Dutch municipalities Based on data from 1990s. Figure 2 shows an updated version by De Groot et al. (2007) using data from 2002. This division in macro zones is used in this paper to investigate differences in business start-ups within the Netherlands.

[2] Amsterdam, Rotterdam, The Hague and Utrecht

Figure 2: Macro-zoning, 2006

2.5 Literature review

This paragraph contains a literature review on past research in the domain entrepreneurship, agglomeration and innovation in the Netherlands.

Pellenbarg and Kok (1985) investigated regional differences in the occurrence of innovating SMEs. The authors compared firm-level data on the innovativeness of firms in different parts of the Netherlands. They categorise innovation in four levels of innovation, namely basic, primary, secondary and tertiary. In their research they focus on the primary to tertiary level of innovation, leaving out the basic (more generic type of) innovation, which has "a more general economic impact" (Pellenbarg and Kok 1985). The reason is, as the authors argue, that SMEs participate in normal innovations rather than large planned R&D based activities (Pellenbarg and Kok 1985). They then compare firm level innovation data from SMEs (firms up to 100 employees) in two of the largest Dutch agglomerations (Rotterdam and Utrecht) on the one hand and a medium sized agglomeration, Arnhem/Nijmegen, on the other. They find that highest innovation rates are not found in the core area of the Netherlands (the Randstad, of which Rotterdam and Utrecht are part of) but rather in the so-called radiation zone (of which Arnhem/Nijmegen is part of). Furthermore, the agglomerations do not stand out with innovation levels above the national average (Pellenbarg and Kok 1985). To investigate this, the authors conducted interviews with multiple SMEs and argue that the search for information has a national and even an international orientation and found that there is no clear relationship between innovation activities and the urban production milieu (Pellenbarg and Kok 1985). This lack of relation was also found in peripheral areas. Their research findings therefore do not confirm the classic image of regional economic and innovation diffusion theories. However, the data the authors used stemmed from the use of patents and, initially, from conducting a short telephone interview in 1% sample of Dutch SMEs. Firstly, not all innovations are patented, leaving out (mostly) incremental innovations. Secondly, investigating the innovativeness of firms by means of interviews and questionnaires are subjective methods of research. How did the respondent interpret the question and what is his reference point? These are well known limitations to using these innovation indicators, however this is also more or less acknowledged by the authors emphasizing the difficulty of measuring innovation (Pellenbarg and Kok 1985).

More recently, in 2002, Van Oort presented his seminal work in which he rather comprehensively, analyses urban growth and innovation. The present paper has adapted several elements stemming from this research. In Van Oort's paper the focus is on economic spatial externalities (agglomeration economies) and its relation to the innovation intensity of firms in the Netherlands. After giving a clear and extensive overview on agglomeration (differences between views from Marshall, Jacobs and Porter), economic externalities, agglomeration economies and growth theory, a conceptual framework is presented, which consists of four dimensions, namely localization and urbanization both from a static and dynamic perspective. Traditionally, agglomeration theory was embedded in a relatively static and non-temporal framework of analysis (Van Oort, 2002). However it is actually this time element that is believed to be of utter importance, because "the agglomerative process tends to be cumulative in nature". Dynamic externalities, as opposed to static externalities, focus on "the role of prior information accumulation in the local area on current productivity and hence employment growth" (Van Oort 2002). As such, there are two types of dynamic externalities, namely one focussing on localization and one focussing on urbanization. In comparison to static externalities, dynamic externalities "have broader implications concerning industrial development over time". It is this element that is of importance to Van Oort's research into the urban growth. Moreover, he stresses that this cumulative growth process is actually limitedly diffusive but has a "rather concentration-inducing character" (Van Oort 2002). Thus, the aim of Van Oort's paper is to investigate the heterogeneity of localized economic growth, or in other words to research the differences in economic growth between regions in the Netherlands and see if this can be linked to the corresponding innovativeness of these regions (either heterogeneous or homogenous of nature). Empirically, Van Oort bases his modelling framework on both Glaeser and Henderson (Van Oort 2002). Van Oort then describes his levels of analysis, namely the "macro economic level", (which divides the Netherlands in The Randstad, the Intermediate Zone and the Periphery), the "regional level" (stating whether it is a core, a suburban, a dependent or a autonomously unconnected municipality) and the "local level" (South Holland). These first two levels of analysis, macro economic level and regional level are also adopted in this thesis and are labelled macro zoning and urban agglomeration respectively (see figure 2 in the paragraph 2.4 and figure 5 in chapter 4.1).

Van Oort then continues and plots the employment density, employment function, innovation density and employment growths. In researching these elements, Van Oort (2002) uses spatial autocorrelation to investigate the effect of agglomeration. Overall, agglomeration theory is confirmed, e.g. municipalities characterized by high levels of employment density are often surrounded by municipalities with high levels of employment density (labelled HH). Consequently, municipalities with low levels of employment density are surrounded by municipalities with low levels of employment density (labelled LL). This means that HL (region with high level of employment density surrounded by low level density municipalities) and LH (vice-versa) regions are less common. This confirms the theory of agglomeration.

Regarding new firm formation, Van Oort again finds "high spatial autocorrelated (HH) values for both new and dissoluted firms in both urban central locations as well in suburban locations and medium–sized cities (Van Oort 2002). Furthermore, the Randstad (South-Holland and lower part of North-Holland) show relative more "HH" areas. Innovation intensities on the other hand show relatively more "HH" areas outside the Randstad. Van Oort also conducts two OLS regressions, one focussing on location industry employment dynamics and the second on sectoral employment dynamics. In both regressions the independent variable is employment growth and he compares South-Holland to the whole of the Netherlands. Van Oort finds empirical support for Jane Jacobs' hypothesis that "knowledge spills over between sectors and that competition fosters growth because of the necessity to innovate and survive" (van Oort 2002). Finally, Van Oort relates urban growth to innovation intensity. The hypothesis here is that agglomeration, and proximity and spatial composition (heterogeneity) is important for the promotion of innovation, knowledge transfer and growth (Van Oort 2002). Ultimately, Van Oort attempts to answer whether employment growth through innovation is best achieved by heterogeneity. Empirically, he finds mixed results. "On the one hand it is found that employment growth and innovation is enhanced by diversity of activity across a broad range of sectors. On the other hand, research concludes on fast (employment) growth when more activity is concentrated in a single sector" (Van Oort 2002). Even though Van Oort's focus is employment growth as a measure for urban growth in cities, his work is of great value for this research. First of all the degree of agglomeration used in this paper has been adopted by using recent data. Second, the division in macro zones has been used to investigate differences between different regions in the Netherlands. Finally, agglomeration and innovation and their relationship with one another is investigated well.

In 2004, together with Atzema, Van Oort looked at the factors that determine new firm formation in the ICT sector. Based on methods and findings used in his seminal paper, Van Oort and Atzema investigate the spatial determinants of new firm formation in the ICT sector in the Netherlands. Results from this research indicate that new establishments in the ICT sector tend to be concentrated in urban areas that are already specialized in this sector and that are relatively rich in the presence of other industries (Van Oort & Atzema 2004). This indicates both localization and urbanization effects, however, they do not find strong evidence to confirm or contradict this. Furthermore, they tested the incubation hypothesis which states that "only larger cities are breeding grounds for new firms". In this respect they conclude the analysis has to be on agglomerated regions, and not on large cities alone. Finally, they conclude that entrepreneurship (measured by firm dynamics) contributes to growth theory.

With regards to innovation, and more precisely regional innovation, Raspe et al. 2004 have mapped several innovation and knowledge indicators (Raspe et al. 2004). This paper's focus is to map knowledge in the Netherlands. To do so, the authors use several indicators on a regional level to ultimately synthesize them. Some of the indicators include the level of education, the ICT sensitivity, the creative economy, the presence of high and medium tech companies and investments (Raspe et al. 2004). Data stems from both Statistics Netherlands and LISA[3]. Furthermore, by means of questionnaires data is retrieved from within companies with regards to innovation activities. The authors then plot all the indicators in a separate mapping of the Netherlands. Graphically, some indicators seem spatially distributed differently than others. By means of factor analysis, the authors combine indicators creating three factors, based on 'knowledge workers', 'innovation' and 'R&D' and plots these into three different maps of the Netherlands. The paper gives useful insights regarding the knowledge economy and especially innovation, even more so, to see how others 'capture' innovation.
The present thesis uses several indicators for the presence of an innovation climate, which are described in more detail in the next chapter. However, as a comparison, the regression analyses that are conducted in this thesis will also be run with the three factors that are concerned with knowledge and innovation, as created by Raspe et al. (2004).

After reviewing the above literature one can conclude that urban growth, especially in terms of employment growth seems higher in places characterised by a relative high degree of agglomeration, possibly due to an increased innovation climate. Van Oort's empirical contribution is of great value and gives important insights used in this thesis. However, this thesis investigates the influences of agglomeration and innovation separately on entrepreneurship.

2.6 Hypotheses

This thesis concentrates on the Netherlands, more specifically on explaining the relative differences in business start-ups between municipalities in the Netherlands, used as a proxy for entrepreneurship. As argued above, positive effects on business start-ups in agglomerated areas with their corresponding innovation environment are expected. The most basic form of an agglomeration is a city, where people and activities cluster together. As described in paragraph 2.2.2, larger cities are expected to exhibit

[3] agency which, among other things, collects spatial data on employment

urbanization economies and therefore show more business start-ups. However, these large cities are presumed to show more diseconomies of agglomeration, such as congestion effects. As diseconomies are difficult to estimate, the largest cities are hypothesized to have more start-ups.

In the Netherlands, the four largest cities are combined in the group ‘G4’, the medium large cities in ‘G27’. In this thesis the remaining municipalities are grouped in ‘Non-G’. As such, the first hypothesis is as follows (containing three sub hypotheses comparing the different city size groups with one another with respect to the relative number of business start-ups).

Main hypothesis 1: city size has a positive effect on the relative number of business start-ups.
H1.a: *G4 municipalities have a higher relative number of business start-ups than non-G municipalities.*
H1.b: *G4 municipalities have a higher relative number of business start-ups than G27 municipalities.*
H1.c: *G27 municipalities have a higher relative number of business start-ups than non-G municipalities.*

With the high dense property of the Netherlands, less urbanized municipalities can benefit from nearby located municipalities with high density of population size, and therefore benefit of the agglomeration economies of that larger municipality. Therefore, to investigate the presence of agglomeration economies and its influence, one needs a more sophisticated agglomeration classification. As is discussed in paragraph 2.2.2, a way to determine a degree of agglomeration is through using Van Oort’s connectedness spatial regime. The degree of agglomeration has been recalculated (shown in chapter 4.1) resulting in three different degrees of agglomeration. A municipality labelled as a ‘core’ region has the highest degree of agglomeration, whereas suburban and rural have intermediate and low levels of agglomeration respectively.

First the focus is on the whole of the Netherlands, dividing all municipalities in one of three levels of agglomeration. Hypotheses 2 to 4 are each divided in three sub hypotheses, comparing the different degrees of agglomeration with one another with respect to the relative number of business start-ups. The following is hypothesized:

Main hypothesis 2: the degree of agglomeration of a municipality in the Netherlands has positive effects on the relative number of business start-ups of that municipality.
H2.a: *core municipalities have a higher relative number of business start-ups than rural municipalities.*
H2.b: *core municipalities have a higher relative number of business start-ups than suburban municipalities.*
H2.c: *suburban municipalities have a higher relative number of business start-ups than rural municipalities.*

To investigate differences in effects of the degree of agglomeration, the macro zones, as discussed in paragraph 2.3, are researched separately. This means that the degrees of agglomeration effects (core, suburban and rural) are tested for in the macro zones.

Second, the focuses is on the Randstad (hypothesis 3), an area with a high concentration of urbanized areas. Due to this property, the Randstad area may be seen as a large urbanized area, in which the degree of agglomeration might not be so beneficial to business start-ups. It is therefore expected that in terms of business start-ups, there are no differences between the degrees of agglomeration. Thus, the following is hypothesized:

Main hypothesis 3: The degree of agglomeration of municipalities in the Randstad has no effects on the relative number of business start-ups of those municipalities.
H3.a*: in the Randstad, core municipalities have no significantly different number of relative business start-ups than rural municipalities.*
H3.b *in the Randstad, core municipalities have no significantly different number of relative business start-ups than suburban municipalities.*
H3.c: *in the Randstad, suburban municipalities have no significantly different number of business start-ups than rural municipalities.*

Third, in the less densely populated areas, the intermediate zone and the periphery, the degree of agglomeration is expected to be advantageous to the relative number of business start-ups, as opposed to the Randstad. This means that in these macro zones one should find a higher number of business start-ups in core areas compared to rural and suburban and also more in suburban than in rural.

To compare the Randstad to the less urbanized areas in the Netherlands, the two remaining macro zones are combined, as they are expected to have similar positive effects to business start-ups. Thus, in this combined region, consisting of the intermediate zone and the periphery, the effects of the degree of agglomeration on the number of business start-ups, are expected to be positive. As such the following is hypothesized:

Main hypothesis 4: The degree of agglomeration of municipalities in the intermediate zone and periphery has positive effects on the relative number of business start-ups of those municipalities.
H4.a: *in the intermediate zone and periphery, core municipalities have a higher relative number of business start-ups than rural municipalities.*
H4.b: *in the intermediate zone and periphery, core municipalities have a higher relative number of business start-ups than suburban municipalities.*
H4.c: *in the intermediate zone and periphery, suburban municipalities have a higher relative number of business start-ups than rural municipalities.*

In addition to the effects of the degree of agglomeration of a municipality, the innovation climate of that municipality can be of influence on the number of business start-ups. Due to knowledge spillovers, agglomerations might be considered as incubators for innovation. There are however, other factors that influence the innovation climate. These factors enhance the benefits for entrepreneurs present in an agglomeration. Therefore, in every model tested for the effects of agglomeration, these indicators for innovation climate are included and are expected to positively influence the number of business start-ups.

Main hypothesis 5: The indicators for the innovation climate of municipalities have positive effects on the number of business start-ups.
H5.a: *the relative number of higher educated labour force has positive effects on the number of business start-ups.*
H5.b: *the relative number of students in higher education has positive effects on the number of business start-ups.*
H5.c: *the relative number of micro firms has positive effects on the number of business start-ups.*
H5.d: *the presence of a university has positive effects on the number of business start-ups.*

3. DATA & METHODOLOGY

To explore the influence of agglomeration and innovation on entrepreneurship, a dataset is constructed containing information regarding municipalities in the Netherlands. This dataset is used to conduct a regression analysis and investigate the above-mentioned influence. In the following paragraph (3.1) the dataset will be described. In the subsequent paragraph (3.2) the methodology used for the regression analysis is elaborated upon.

3.1 Dataset

The dataset used in this analysis is constructed out of data stemming from 2006 and extracted from multiple sources, including Statistics Netherlands (CBS) and the Chamber of Commerce. The year 2006 is chosen, because it is the most recent year for which all necessary data is available. Furthermore, it is the last 'normal year' prior to the economic crisis witnessed in 2008, which could be of great influence on the employment rate[4]. The data has been collected for Dutch municipalities. Initially, the dataset consisted of 458 municipalities. However, some municipalities, merged between 2006 and 2007. The data extracted from the chamber of commerce (stemming from 2006, and was furthermore the only available year) appears to already have incorporated these mergers even though they took place in January 2007. Therefore, some municipalities showed extremely high values of business start-ups while other municipalities, which were involved with these mergers, were not included in this database. Thus the data collected from CBS and the Chamber of Commerce showed some inconsistencies. Therefore, in some cases the data for these municipalities were combined as if they were already merged. Because of this, the number of observations declined to 454. Furthermore, to control for size differences absolute data is divided by the labour force to make the data comparable. The labour force is chosen, as opposed to the number of inhabitants, because this is the potential pool for entrepreneurs and also the calculated connectedness (discussed in chapter 2.2.2), used in this research is based on employees. CBS only provides data on the labour force for municipalities with more than 10,000 inhabitants[5]. As a consequence the number of observations declined to 389. Finally, due to some missing values, the final dataset consists of 372 observations (N=372).

In the analysis one dependent, and thirteen independent variables are used, of which seven independent variables are control variables. Furthermore, a selection variable is used in occasions to test in different regions macro zones in the Netherlands (as described in chapter 2.4). The dependent, independent and selection variables will now be further elaborated upon. Appendix A contains an

[4] The economic crisis in 2008 could have strong effects on the number of business start-ups, due to increased unemployment, reduced lack of access to capital and general unfavourable economic conditions

[5] CBS state that labour force numbers are not published for municipalities with less than 10.000 inhabitants due to measuring reliability

overview with a short description of the used variables in the dataset that are discussed in this paragraph.

Dependent variable

To measure entrepreneurship, this thesis uses business start-ups as a proxy for entrepreneurship. To construct the dependent variable (‘StartupsLF’), the number of independent start-ups per municipality has been collected from the Chamber of Commerce (Kamer van koophandel 2007). The focus of this research is on independent start-ups, thus leaving out new subsidiaries. These numbers have been divided by the labour force per municipality, extracted from CBS, to make the rate of entrepreneurship comparable between municipalities.

Independent

There are two types of independent variable used in the models with respect to agglomeration. Starting with the city size (G4, G27 and non-G), used in the first hypothesis, followed by the degree of agglomeration (core, suburban and rural), used for hypothesis 2 to 4.

The first independent variable for agglomeration is city size. Based on information from the ministry of housing, spatial planning and the environment (ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer 2009) for each municipality in the dataset was determined whether they belong to the G4, G27 or non-G group. The resulting variable, regarding city size, was originally a categorical variable. This categorical variable was then transformed into three dummies, namely ‘dummy_g4’, ‘dummy_g27’ and ‘dummy_nong’. Each municipality can only be in one these categories, ‘1’ representing membership of the corresponding category and ‘0’ means they are member of a different category.

The second independent variable for agglomeration is the degree of agglomeration. As described in chapter 2 (paragraph 2.2.2), Van Oort’s connectedness spatial regime (updated with data from 2006; result shown in chapter 4.1) is used as a basis for this independent variable. However this model for connectedness first needs to be updated with more recent data. This updated version will then be transformed into a categorical independent variable, stating whether a municipality is either ‘core’, ‘suburban’ or a ‘rural’. This categorical variable will then be divided in three dummies, namely ‘dummy_core’, ‘dummy_suburban’ and ‘dummy_rural’. Each municipality can only be in one these categories, ‘1’ representing membership of the corresponding category and ‘0’ means they are member of a different category.

Regarding the innovation climate, four indicators are used. Data for each of these indicators are extracted from Statistics Netherlands (CBS).

The first indicator is the proportion of the labour force with higher education ('HighEdu_LF'). Here, the proportion of the labour force with higher education is taken as a ratio of the labour force of a municipality. The second indicator for an innovation climate is the relative number of students in higher education ('StudentsHE_LF'). Again, to make it comparable, this is taken as a ratio of the labour force. Furthermore, the number of micro firms as a ratio of the labour force is used as a third indicator ('Micro_firms_LF'). Firms that employ less than 10 persons are categorized by CBS as 'micro firms'. The fourth and final indicator for innovation climate is the presence of a university ('dummy_UNI'). This dummy variable states whether an agglomeration has a university (=1) or not (=0). Both Dummy_uni and StudentsHE_LF are included in the model which intuitively might seem positively correlated with one another. There is correlation between the two, however the assumptions are not violated (which are elaborated upon underneath). Dummy_uni is included to represent the concentration of knowledge in a single location, in which spillover are expected to occur in close proximity. In the Netherlands there is however, a moderate number of universities, thus not all municipalities contain a university. However, the presence of a university is also expected to influence surrounding municipalities. As such municipalities that are part of the agglomeration, in which there is a university, are also expected to benefit of this. These municipalities therefore have a value 1 in the dummy. The innovation climate in the Netherlands is expected to benefit from the number of students present in a municipality. Furthermore, the number of students represent the diffusion of knowledge (knowledge spillover).

As a final note, regarding the indicators for an innovation climate, the innovation climate is expected not to be bounded per se by the borders of municipalities within agglomerations. Suburban municipalities are expected to benefit from the innovation climate of the core. By only considering the climate of a specific suburban municipality, these benefits are not taken into account. As such, the values for the innovation indicators of suburban municipalities are combined with the values of the core municipality to which it is connected. However, as the core municipalities are the centre of the agglomeration, the values for the individual core municipalities are left unchanged. Suburban municipalities enjoy benefits due to the connectedness to a core municipality. It is expected that suburban municipalities gain more in terms externalities (thus also innovation climate) from connectedness to core municipalities than vice versa. Thus, for suburban municipalties the innovation climate is calculated by adding the (innovation indicator) values of core municipalities, thus increasing the innovation climate for suburban municipalities. For core municipalities on the other hand, values for suburban municipalities are not added as the division by the total labour force (core + suburban) will lower the values with regards to the innovation climate.

In addition to using these main independent variables (for agglomeration and innovation climate) described above, seven control variables are entered in the model, which will now be discussed. Firstly, unemployment ('unemployment_LF') is used as a control variable. Here, the measure of the unemployed part of the labour force is taken as a ratio of the labour force, again to make it comparable between municipalities. This variable controls for both demand and supply factors of entrepreneurship. When unemployment is high, the pool of potential (necessity) entrepreneurs is larger, but potential entrepreneurs might postpone their entrepreneurial aspirations due to the increased opportunity costs. Furthermore, the demand will be lower. Due to a higher unemployment, the consumption is expected to decrease. When unemployment is low, the effects will be opposite.

Secondly, the growth of unemployment is taken into account (‘unemploy_growth’). In addition to the static measure of unemployment, a dynamic growth indicator is included to control for changes in the demand and supply for entrepreneurship. The static measure indicates the general status of the labour market. For example, higher levels of unemployment are associated with depressed conditions, influencing decisions to start a business. On the other hand, unemployment growth indicates the change in unemployment and thus the change in these conditions and is therefore also included. The growth of unemployment is calculated as the change in the relative number of the unemployed labour force between 2004 and 2006.

Thirdly, the population growth is included (pop_growth_0306) to control for changes in demand and supply for entrepreneurship. A larger population increases demand for products and services but also increases the pool of potential entrepreneurs. Here, the growth between 2003 and 206 is calculated. Due to the fact that some municipalities merged in this period the data on population for these merged municipalities has been added so that there is a natural growth rate, instead of an instant increase which could bias the outcome.

Fourthly, as population density is expected to influence the number of business start-ups it is also included (‘density_2006’). This variable is extracted from Statistics Netherlands, which have calculated the number of inhabitants per square kilometre for each municipality.

Fifthly, GDP per capita (‘gdp_capita’) is incorporated in the dataset as measure for the overall welfare of a municipality. A high GDP increases the access to financial resources but also increases purchasing power, which is in favour of demand. On the other hand, a high GDP per capita implies higher wage cost for employment, which could negatively influence the number of business start-ups.

Sixthly, GDP per capita growth (‘gdp_growth_0306’) has been added, also for its influences on demand and supply for entrepreneurship, but now controlling for changes between 2003 and 2006.

Finally, the growth of immigrants is taken into account (‘immigrants_growth’) to control for changes in the number of immigrants in a municipality. This measure incorporates the high share of entrepreneurship in ethnic populations. Thus, increased levels of immigrants can influence the number of business start-ups. The total number of immigrants is not included, because, during the regression analysis (with this variable included), multicollinearity as a statistical assumption was violated.

Selection variable

Hypothesis 3 and 4 focus on the effects of the degree of agglomeration in different macro regions within the Netherlands (Randstad, intermediate zone and periphery). Based on the model described in chapter 2.4, the variable 'macro_zoning' was constructed stating for each municipality in which macro zone it is located. To research the effect of the degree of agglomeration on business start-ups in a particular region, this variable is used as a selection variable. This way only the municipalities that are in the macro zone required are selected.

Appendix B gives an overview of which variables are used in the model (which will now be described) and categorized by its type (dependent or independent).

3.2 Methodology

This paragraph describes the methods used for the empirical research. First, the update concerning the connectedness spatial regime, created by Van Oort, with more recent data is described. Second, the econometric models used in the regression are elaborated upon. This is done by using the framework displayed in figure 1, however now updated with the variables described in the previous paragraph, to give a clear overview of the methods used. Finally, the required assumptions concerning the regression analysis will be briefly explained.

Connectedness as measure for the degree of agglomeration

As mentioned in chapter 2.2.2 regarding the degree of agglomeration in the Netherlands, this thesis makes use of Van Oort's connectedness spatial regime. Using this model, Van Oort classified each municipality to either being 'core', 'suburban', 'dependent' or 'autonomous'. This classification is based on the commutement of employees to and from municipalities. For each category, Van Oort has set requirements. First, to be labelled as 'core', a municipality needs at least 15.000 in-commuting persons residing in municipalities other than the one at hand. Second, when twenty percent of a municipality's employees are employed in the nearby core region, it is labelled as 'suburban'. The remaining municipalities are classified as 'unconnected'. However, using a location quotient Van Oort divides this category into two sub categories, namely 'dependent' and 'autonomous'. In the recalculation of this connectedness spatial regime, no distinction is made in the latter unconnected and self supporting category, thus resulting in three degrees of agglomeration, namely 'core', 'suburban' and 'rural'. In order to construct this model, data has been collected from Statistics Netherlands regarding commutement of employees. First, all in-commuting data is analysed to see which municipalities have over 15.000 employees from outside municipalities on a daily basis. By doing so, the core regions can be identified. Second, the out-commuting data is reviewed. For each municipality it will be determined whether twenty percent of its employees are working in a single core nearby. Consequently, municipalities that exhibit such figures will be labelled as 'suburban'. Once the 'core' and 'suburban' municipalities are identified, the remaining group can be labelled as 'rural', showing no single dependency on one municipality with respect to employment.

Econometric models

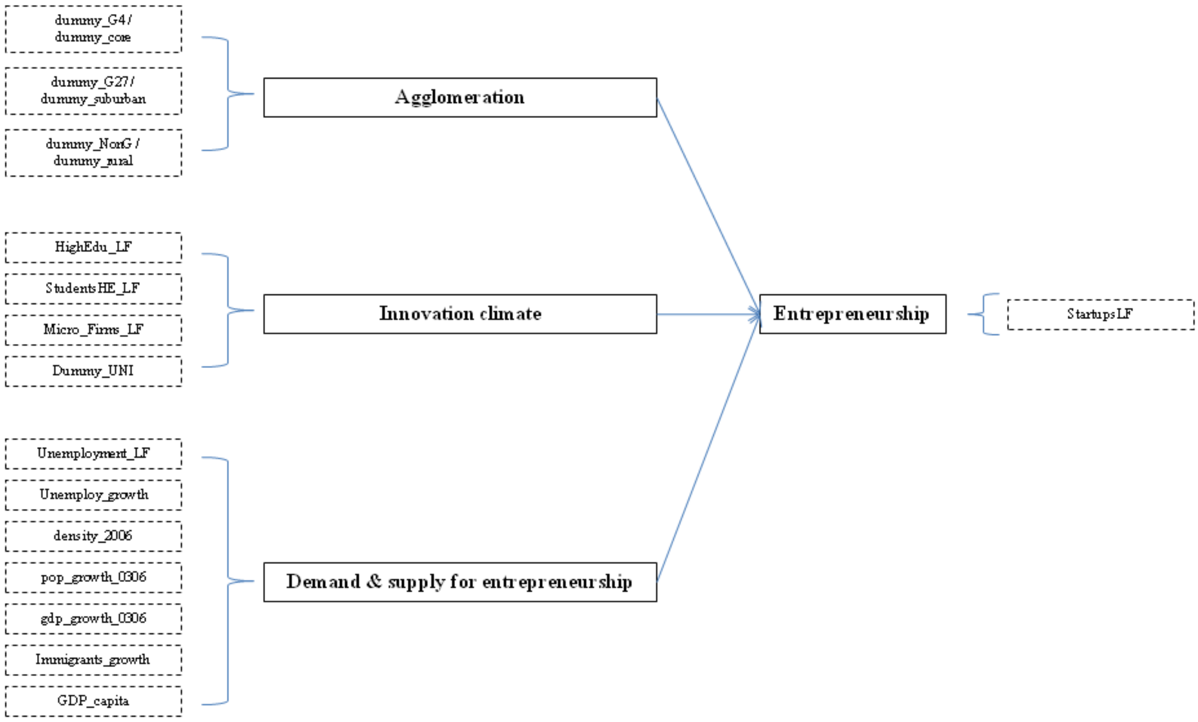
All of the variables, mentioned in paragraph 3.1, are continuous, therefore a regression analysis is the preferred method of analysis. By doing so, one can investigate the linear relation between the dependent and the independent variables. In order to test the five proposed hypotheses, four models will be used. A graphical representation is showed in the expanded framework (figure 3, displayed below), showing all variables that are entered in the regressions. All four models use the same variables for innovation and demand and supply. However, the variables for agglomeration differ.

For the first model ("G4-G27"), the variable used to identify agglomeration, is based on city size. The dummies 'G4', 'G27' and 'non-G' enter the model for agglomeration (as can be seen in the figure). To be able to compare the different dummies, two versions of the models are run, one with 'non-G' as a reference category and one with 'G27' as reference category. With regards to innovation, 'HighEdu_LF', 'StudentsHE_LF', 'Micro_firms_LF' and 'Dummy_UNI' are entered. Furthermore, the demand and supply indicators (as displayed in figure 3) are entered[6]. The complete linear relation between the dependent and independent variables, for model 1, is shown in (1). The constant is denoted by α, whereas the coefficient is indicated by β. Furthermore, the ε signifies the residual.

(1)
$$\begin{aligned} StartupsLF &= \alpha + \beta 1(dummy\_g4) + \beta 2(dummy\_g27/NonG) + \beta 3(HighEdu\_LF) + \beta 4(StudentsHE\_LF) \\ &+ \beta 5(Micro\_Firms\_LF) + \beta 6(Dummy\_UNI) + \beta 7(pop\_growth\_0306) + \beta 8(density\_2006) + \beta 9(gdp\_growth\_0306) \\ &+ \beta 10(GDP\_capita) + \beta 11(Unemployment\_LF) + \beta 12(unemploy\_growth) + \beta 13(immigrants\_growth) + \varepsilon \end{aligned}$$

6 Control variables: 'Unemployment_LF', 'Unemploy_growth', 'Density_2006', 'Pop_growth_0306', 'Gdp_growth_0306', 'Gdp_capita' and 'Immigrants_growth'.

Figure 3: framework, expanded with variables



The second model ("The Netherlands") incorporates the degree of agglomeration, as opposed to model 1. Instead of regressing the city size, now the degree of agglomeration (recalculated connectedness) is used for agglomeration. This is also shown in the figure above, in which dummy_core, dummy_suburban and dummy_rural enter the model for agglomeration. For both innovation climate and demand and supply the variables used remain the same as in model 1 ("G4-G27"). Again, in order to be able to compare all three agglomeration dummies, two versions will be run, the first one with dummy rural as a reference category and the second one with dummy suburban as a reference category. The linear relation for this model is shown in (2). As in the previous linear function, the constant is denoted by α, whereas the coefficient is indicated by β. Furthermore, the ε signifies the residual.

(2)
$$\begin{aligned} StartupsLF &= \alpha + \beta 1(dummy\_core) + \beta 2(dummy\_suburban/rural) + \beta 3(HighEdu\_LF) + \beta 4(StudentsHE\_LF) \\ &+ \beta 5(Micro\_Firms\_LF) + \beta 6(Dummy\_UNI) + \beta 7(pop\_growth\_0306) + \beta 8(density\_2006) + \beta 9(gdp\_growth\_0306) \\ &+ \beta 10(GDP\_capita) + \beta 11(Unemployment\_LF) + \beta 12(unemploy\_growth) + \beta 13(immigrants\_growth) + \varepsilon \end{aligned}$$

Model 3 ("The Randstad") and 4 ("The intermediate zone & periphery") are in principle the same as model 2 ("The Netherlands"). The main difference between model 2, 3 and 4 is the use of the selection variable (as discussed in the previous paragraph). By using this selection variable, only the municipalities concerned with a particular macro zone are included as observations in the analysis.

Assumptions

In order to be able to draw conclusions based on the outcome of the analysis, several assumptions must be tested for (Field 2005), these include: normality, multicollinearity, heteroskedasticity and autocorrelation.

Firstly, for normality the distribution of residuals needs to be normal at every value of the dependent variable. When there is a lack of normality, the position of the regression slope can be biased and make the standard errors wrong. However, usually for large samples (df>20), non-normality does not harm regression results seriously. Even though, the sample size in this research is large enough, normality is tested for in all of the described models. The starting point to test for normality is to view the distribution of the residuals. Here, one looks for similarities with a perfect normal distribution. To test this formally, the skewness and kurtosis test are conducted. The skewness indicates, as the name suggests, whether the distribution is skewed and if so if the skewness is to the left or the right (Field 2005). Kurtosis provides a measure of the thickness of the tails of the distribution or pointyness (Pindyck and Rubinfeld 1998; Field 2005). For both skewness as well as kurtosis the rule of thumb is that the value should be within the critical values of -2 and 2.

Secondly, no exact linear relationship may be present between any of the independent variables in the model. When such a relationship does exist, one speaks of multicollinearity between independent variables. To test for multicollinearity the collinearity tolerance and the variance inflation factor (VIF) are calculated. The VIF is calculated by diving 1 by the collinearity tolerance. The critical value for VIF is 5 and therefore the critical value for tolerance is 0.2 (Aczel and Sounderpandian 2002). If the calculated values are below 5 for VIF and above 0.2 for tolerance, it is expected that no multicollinearity is present.

Thirdly, the variance of the residuals should be constant. If this is not the case, then Heteroskedasticity might become a problem, because if the variances are unequal, then the relative reliability of each observation (used in the regression) is unequal. Thus, the larger this variance, the lower should be the importance attached to that observation. The danger here is that a true null hypothesis is rejected, also known as a type-1 error (Aczel & Sounderpandian 2002). A first indication of heteroskedasticity can be observed in a scatterplot of the predicted values and the residuals by seeing if there is a noticeable pattern of an increasing residual variance. This is called the Time-Honored- Method of Inspection (THMI). However, to test formally for heteroskedastcity, one needs to conduct the White's test. In this test a regression is done, with the squared residual as a dependent variable. First, all independent variables used in the original model need to be included. Second, the squared values of the independent variables need to be included. Finally, all independent variables need to be multiplied with one another (cross products) and also be entered in the model. The outcome of this regression yields a R-square. This R-square is then multiplied by the number of observations in the model. If this product is lower than the critical value of the Chi-Square distribution for significance level of 5% ($nR^2<\chi^2$).

Fourthly, autocorrelation needs to be tested for. No autocorrelation means that errors of the regression model are independent from observation to observation. To test for autocorrelation, the Durbin-Watson statistic is reviewed. The test statistic can vary between 0 and 4 with a value of 2 meaning that the residuals are uncorrelated (Field 2005). The critical values are 1.5 and 2.5. The Durbin-Watson value therefore, needs to lie in between. When there is a value less than 2 there is positive correlation between the residuals (Field 2005). Consequently, values above two indicate a negative correlation (Field 2005). However, Gupta (1999) argues that autocorrelation is only relevant in time series data. Nonetheless, autocorrelation as an assumption is still tested for.

Finally, the multiple coefficient of determination (R^2) "measures the proportion of the variation in the dependent variable that is explained by the combination of the independent variables in the regression model" (Aczel & Sounderpandian 2002). A low R-square value therefore suggests that there are other influences (not included in the regression). Roughly speaking, high values of R^2 are associated with a good fit of the regression line, whereas low values are associated with a poor fit. However, in cross-section studies (as the one conducted in this paper), a lower R^2 value may occur even if the model is a satisfactory one because of the large variation across individual units of observation (Pindyck & Rubinfeld 1998).

4. EMPIRICAL RESULTS

This chapter contains the results for each of the four models used to test the null hypothesis. Each section shows a table with results for all the independent variables used in the model. The table provides the output given by SPSS for the independent variable's β-Coefficient, standard error, *T*-test and p-value. The β-Coefficients are the values for the regression equation (see equation (1) and (2) in the previous chapter) for predicting the dependent variable from the independent variable. For example, if an independent variable has a β-Coefficient of 0.5 then the dependent variable is predicted to increase with 0.5 when the independent variable increases with one. The standard error represents how much error there is in the prediction of the regression equation for the dependent variable's value of any individual case as a function of the independent variable. The *T*-test divides the β-Coefficient by the standard error. The p-value (significance) reflects whether the value for T-test is significantly different from zero. A high standard error results in a lower t-test, and therefore a lower probability to reject the null hypothesis.

Concludingly, one can reject the null-hypothesis, i.e. that there is no significant influence, when the p-value is lower than the used significance level (either being 5% or 10%).

This chapter is structured as follows: paragraph 4.1 shows the result of the recalculation of the connectedness spatial regime using data for 2006, graphically showing the degree of agglomeration for each municipality in the Netherlands. Also, a comparison is made to the original connectedness as calculated by Van Oort based on data from the 1990s. Paragraphs 4.2 to 4.5 respectively show the results for the G4-G27 (model 1), the Netherlands (model 2), the Randstad (model 3) and the intermediate zone & periphery combined (model 4). Also, because a multiple dummy is used (in this case three dummies for G4, G27 and Non-G in model 1 and core, suburban and rural in the remaining models) two out of three dummies are a run in the model in which the one that is left out acts as a reference category. As such, the outputs in paragraph 4.2 include 'dummy_g4' twice, once with 'dummy_g27' as a reference (denoted with [A]) and once with 'dummy_non-G' as a reference (denoted with [B]). The same goes for dummy core in the remaining models. This dummy is also mentioned twice in paragraph 4.3 to 4.5, once to compare it to dummy_rural (denoted with [A]) and once to compare it to dummy_suburban (denoted with [B]). Furthermore, each paragraph reflects on the outcomes of the tested assumptions, as described in the previous chapter. The full outputs concerned with these assumptions (also containing the original regression outputs from SPSS) are found in appendix C.

4.1 Degree of urban agglomeration

To conduct the research as proposed, the degree of agglomeration needs to be determined per municipality. For this research the connectedness spatial regime developed by Van Oort (2002), as described in chapter 2.2.2, is used. However, the connectedness used by Van Oort (2002) used data from 1990 to 1999. Therefore, the connectedness between municipalities has been recalculated using data from 2006. The original connectedness spatial regime by Van Oort contains 4 degrees of agglomeration, namely 'core', 'suburban', 'dependent' and 'autonomous'. In this recalculation the latter two categories have been grouped together to form the 'rural' group. Thus, now there are three resulting degrees of agglomeration: core, suburban and rural (for a more detailed description refer to chapter 3.2). A graphical overview of this result can be found in figure 5. Additionally, figure 4 contains the original overview of the connectedness spatial regime as constructed by Van Oort in 2002 based on data between 1990-1999.

Figure 4: The connectedness spatial regime (1990-1999)

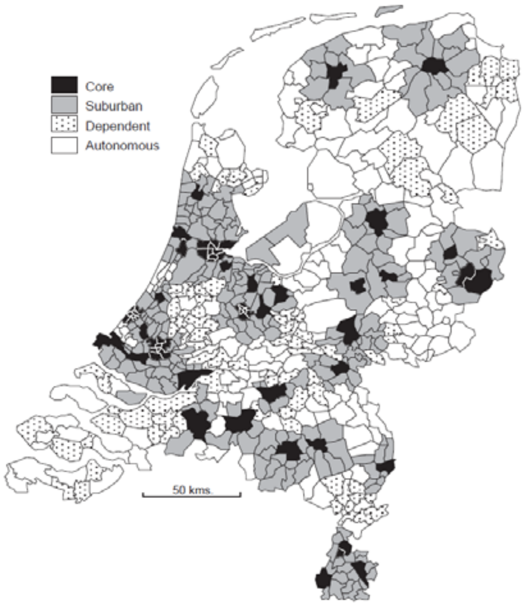
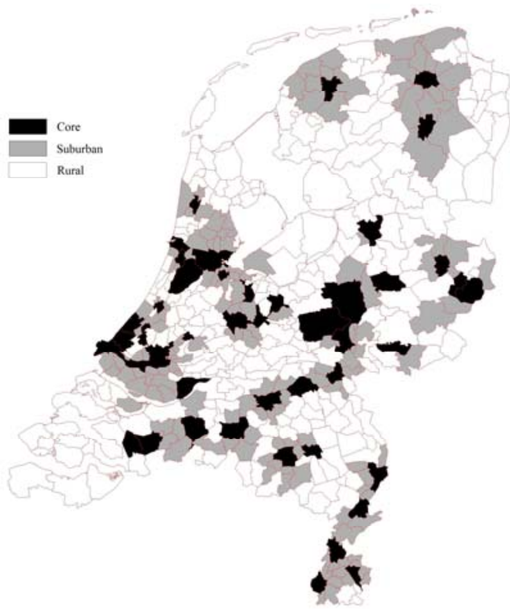


Figure 5: Urban agglomeration (2006)



Source: Van Oort (2002)

When comparing above graphical representations of 1999 and 2006, there are some interesting changes visible. The first and most remarkable difference between both figures is the enlarged core area in the centre of the Netherlands. Compared to the 1990s there is now a large core area, which consists of two large municipalities, namely Ede and Apeldoorn forming the largest geographical core region within the Netherlands. However, this is mainly due to the fact these municipalities that have merged with their surrounding municipalities, now covering larger geographical area.

A further difference between the 1990s and 2006 is the emergence of several core areas. Compared to 1990s, all municipalities that were labelled as core remained with the addition of several new core municipalities. For example in the northern provinces an entire new core area emerged, namely the municipality 'Assen'. For a municipality to be a core, within the connectedness spatial regime, a municipality needs to have 15.000 in-commuting persons. As such, municipalities directly surrounding this new core are likely to be supplying these in-commuting persons. Therefore, it is no surprise that with the emergence of this new core, several suburbs emerged surrounding this core. Furthermore, in the southwest, the municipalities ‘Roosendaal’ and ‘Bergen op zoom’ are now, as opposed to the 1990s, core municipalities. In the province of Limburg, in the southeast, ‘Roermond’ is now also a core municipality, thus having more than 15.000 in-commuting persons on a daily basis. Also, in the data of the 1990s two municipalities, ‘Berghem’ and ‘Megen Haren and Macharen’ where separate. However in 1994 these municipalities merged with ‘Oss’, which now form a new core region in the upper southeast of the Netherlands.

In the Randstad area, already known for its high population density and relative high number of agglomerations, a few differences are visible as well. First, the Amsterdam core area has grown, now consisting of additional core municipalities together forming this agglomeration. Second, both ‘The Hague’ and ‘Rotterdam’ are now larger core regions. Surrounding municipalities are now also labelled core areas adding to the increased geographical surface of the core regions. Third, ‘Utrecht’ has become a larger core area as well, now covering a larger surface in the centre of The Netherlands.

Compared to the 1990s, 2006 shows less suburban municipalities, some have become core areas, other however are now classified as rural, meaning that they are self supporting and thus not depending as such on a neighbouring core area. What is remarkable is the increase of rural areas in the Randstad. To be classified as suburban, 20 percent of a municipality’s labour force commutes to a nearby core region on a daily basis. However, with the increased number of core regions within a geographically smaller area it might even be so that some municipalities have even more than 20 percent of out-commuting persons, however, possibly spread over multiple core areas. As such they are not labelled as suburban. This might also be a shortcoming of the method at hand. Nonetheless, with the increased number of core areas, the degree of agglomeration as a whole in the Netherlands has increased compared to the 1990s. This corresponds to the increase in the population from roughly 14.9 million in 1990 to over 16.3 million in 2006 (CBS 2009b).

The resulting degree of agglomeration is used in the model 2, 3 and 4. However, before regressing the influence of the degree of urban agglomeration on the number of business start-ups, the regression was run with the four largest metropolitan cities (G4), the 27 large municipalities (G27) (excluding G4) and the municipalities that are not part of either of them. This was done to test whether the largest municipalities have more business start-ups compared to the rest of the Netherlands, irrespective of the connections between municipalities. These results are shown in the next paragraphs.

4.2 Results model 1: "G4-G27"

Table 1 shows the regression results for model 1. The outcome for model 1 version A compares both dummy_g4^A and dummy_g27^A to dummy_non-g. The latter dummy is not included in the table as it is the reference group and is the exact inverse of dummy_g27 ^A, meaning that positive values for dummy_g27^A will be the same, however negative and vice versa.

Table 1: regression results model 1 A & B– "G4-G27"

Variables	β-Coefficient	Std. Error	T-test	Significance (p-value)
(constant)	6.624	1.413	4.688	0.000
	Agglomeration			
Dummy_g4 ^A	1.538	1.062	1.448	0.148
Dummy_g4 ^B	0.637	1.060	0.601	0.548
Dummy_g27 ^A	0.901	0.434	2.079	***0.038**
	Innovation climate			
HighEdu_LF	0.006	0.014	0.417	0.677
StudentsHE_LF	0.001	0.003	0.521	0.602
Micro_firms_LF	0.050	0.004	13.516	***0.000**
Dummy_UNI	0.041	0.359	0.113	0.910
	Demand and supply			
Pop_growth_0306	0.084	0.043	1.951	****0.052**
Density_2006	1.013E-5	0.000	0.081	0.935
Gdp_growth_0306	-0.032	0.059	-0.536	0.593
Gdp_capita	-0.168	0.073	-2.298	***0.022**
Unemployment_LF	0.124	0.054	2.285	***0.023**
Unemploy_growth	-0.057	0.076	-0.760	0.448
Immigrants_growth	-0.032	0.034	-0.936	0.350

Note: (^A) denotes output from version A: dummy_g4 compared to dummy_NonG; (^B) denotes output from version B: dummy_G4 compared to dummy_NonG; (*) significant at 5% level; (**) significant at 10% level; statistical calculations done with SPSS.

The coefficient of determination (R-square) of this model equals 0.374. Therefore 37.4% of the variation in the dependent variable is explained by the independent variables in the model (appendix C).

Agglomeration

Model 1 version A shows no significant results for the dummy_g4 variables. The dummy_g4^A has a positive β-coefficient of 1.538 and a standard error of 1.062. The p value is 0.148 and therefore the null hypothesis that the coefficient is not significantly different from zero, cannot be rejected. Furthermore, with a β-coefficient of 0.637, a standard error of 1.060 and a p-value of 0.548, the dummy_g4^B shows no significant difference compared dummy_g27. Thus, it cannot be assumed that there are more business start-ups in the four largest cities in the Netherlands compared to the small and medium sized cities categorized by 'non_g' and 'g27'. The results however, do show a significant difference between dummy_g24 and dummy_nong. The β-coefficient is 0.901, the standard error

0.434 and the p-value 0.038. This means that municipalities that belong to the g27 have significantly more business start-ups compared to the small and medium sized municipalities.

Innovation climate

With respect to the innovation climate three indicators do not show significant results. The higher educated labour force has a positive β-coefficient of 0.006 (standard error 0.014) and a p-value of 0.677. The variable representing students in higher education has a positive β-coefficient of 0.001 (standard error 0.003) and a p-value of 0.602. The dummy university, stating whether or not there is a university present, also shows no significant influence, with a β-coefficient of 0.041 (standard error 0.359) and a p-value of 0.910. As such these variables cannot be assumed to have an influence on the number of business start-ups. One innovation climate indicator however, is found to have a significant influence in the number business start-ups, namely the relative number of micro firms. With a β-coefficient of 0.050, a standard error of 0.004 and a p-vale of 0.000 this indicates that the null hypothesis that the presence of micro firms has no influence on the number of business start-ups can be rejected. Thus, it does suggest a positive effect on entrepreneurship.

Demand and supply

With respect to the control variables entered for the demand and supply of entrepreneurship, four variables show no significant influence. However, three variables do. The first significant variable is population growth (β-coefficient 0.084, standard error 0.043 and p-value 0.052). The second significant variable is gdp per capita, which has negative β-coefficient of -0.168 (standard error 0.073) and a p-value of 0.022. Finally, unemployment shows a significant (p-value 0.023) and positive influence (β-coefficient 0.124, standard error 0.054) on the number of business start-ups. It seems that an increase in both population growth and unemployment appears to have positive and influential effect on the number of business start-ups, whereas an increase in the gdp per capita affects the number of business start-ups negatively.

Assumptions

In model 1 both the skewness (0.095) and the kurtosis (1.520) are within the critical values of -2 and 2. Therefore normality can be assumed, as is also shown by the normality curve in the histogram (appendix c). With respect to multicollinearity, none of the values for tolerance of the independent variables are below 0.2. Furthermore, none of the values for VIF are above 5. Thus, indicating an absence of multicollinearity. Also, as a test for autocorrelation, the Durbin-Watson statistic is 1.908. This means that there is slight positive correlation between the independent variables. However, this statistic lies within the critical values of 1.5 and 2.5 and thus there is no cause for concern. The next assumption that is tested for is heteroskedasticity. The scatterplot shows no distinctive pattern. The White's test shows that $nR^2 = 125.74$ which is slightly above the critical value of 124.3 (the chi-square

(5%) for degrees of freedom (100) = 124.3 (Aczel & Sounderpandian 2002)). However, it does not exceed the critical value for 1 % (135,81). Having said this, all the assumptions are met and as such conclusions can be drawn based on the outcomes of the regression.

4.3 Results model 2: "The Netherlands"

The results for the second model are provided in table 2. For the same reasons as mentioned in the results for model 1, dummy_core[A] is listed twice in this table, to compare it to the other dummies. Dummy_core[A] reflects the difference between core municipalities and rural municipalities. Dummy_core[B], on the other hand, shows the difference with respect to suburban municipalities.

Table 2: regression results model 2 – "The Netherlands"

Variables	β-Coefficient	Std. Error	T-test	Significance (p-value)
(constant)	6.906	1.404	4.919	0.000
	Agglomeration			
Dummy_core [A]	1.001	0.390	2.565	***0.011**
Dummy_core [B]	0.862	0.401	2.147	***0.032**
Dummy_suburban [A]	0.139	0.299	0.467	0.641
	Innovation climate			
HighEdu_LF	0.004	0.014	0.306	0.759
StudentsHE_LF	0.001	0.003	0.315	0.753
Micro_firms_LF	0.050	0.004	13.450	***0.000**
Dummy_UNI	0.113	0.382	0.297	0.767
	Demand and supply			
Pop_growth_0306	0.086	0.043	1.983	***0.048**
Density_2006	2.182E-5	0.000	0.181	0.857
Gdp_growth_0306	-0.015	0.059	-0.256	0.798
Gdp_capita	-0.189	0.072	-2.610	***0.009**
Unemployment_LF	0.128	0.054	2.386	***0.018**
Unemploy_growth	-0.055	0.076	-0.727	0.467
Immigrants_growth	-0.034	0.034	-1.004	0.316

Note: ([A]) denotes output from version A: dummy_core compared to dummy_rural; ([B]) denotes output from version B: dummy_core compared to dummy_suburban; (*) significant at 5% level; (**) significant at 10% level; statistical calculations done with SPSS.

The R-square, in this model, equals 0.376. This means that 37.6% of the variation in the dependent variable is explained by the independent variable in the model.

Agglomeration

For the Netherlands, dummy_core[A] has significantly more business start-up compared to both dummy_rural and dummy_suburban[B]. With a β-Coefficient of 1.001 and a standard error of 0.390, the and a p-value of 0.011 core municipalities (dummy_core[A]) have significantly more business start-ups than rural municipalities (dummy_rural). Furthermore, with a β-Coefficient of 0.862, a standard error of 0.401, and a p-value of 0.032 core municipalities (dummy_core[B]) have significantly more business start-ups than suburban municipalities (dummy_suburban). Suburban municipalties

(Dummy_sbuburban), on the other hand show no significant difference with respect to rural municipalities (dummy_rural). Thus, for the Netherlands, the agglomeration economies, present in the core, seem to positively influence the number of business start-ups. Suburban municipalities, however, do not seem to benefit from these agglomeration economies, as they show no difference in business start-ups compared to rural municipalities.

Innovation climate

Similar to model 1, three indicators for the presence of an innovation climate show no significant influence on the number of business start-ups. However all of these three indicators show positive coefficients, but none of them are significantly different from zero. The variable higher educated labour force, students in higher education and dummy university show no significant results. Similarly, the presence of micro firms shows a positive (β-Coefficient of 0.050, standard error of 0.004) and significant influence (p-value 0.000) on the number of business start-ups in municipalities.

Demand and supply

The demand and supply variables show three out of seven significant results. First, population growth has a positive β-Coefficient of 0.086 (standard error of 0.043) and a p-value of 0.048. Second, unemployment has a positive β-Coefficient of 0.128 (standard error of 0.054) and a p-value of 0.018. Finally, gdp per capita also has a significant p-value of 0.009. De β-Coefficient, however, is negative (-0.0189). Thus, population growth and unemployment seem to positively influence the number of business start-ups, whereas gdp per capita has a negative influence.

Overall, the innovation climate indicators and demand and supply factors show similar results when comparing the first two models ("G4-G27" and "The Netherlands").

Assumptions

The second model shows values of 0.095 for skewness and 1.517 for kurtosis and are thus within the critical values of -2 and 2. As also confirmed by the normality curve in the histogram, normality can be assumed. Next, multicollinearity is tested for. All values of tolerance are above 0.2 and all values for VIF are below 5. Therefore, multicollinearity is regarded as absent. With respect to autocorrelation, the Durbin-Watson statistic shows a value of 1.917, suggesting a slight positive correlation between the independent variables. This is, however, still between 1.5 and 2.5, so there is no reason for concern. The scatterplot suggests a slight indication of heteroskedasticity, however after conducting the white's test, the nR^2 is 120.9 and thus lies below the critical value of 124.3. Consequently, no heteroskedasticity is present (Aczel & Sounderpandian 2002). Concludingly for the second model, the assumptions are met, and thus conclusions can be drawn from the results of model 2.

4.4 Results model 3: “The Randstad”

The results for model 3 are shown in table 3 underneath. The model used for the Randstad is the same as for the Netherlands, with the exception that the selection variable is introduced. Therefore, only observations that lie within the Randstad area are included. Furthermore, for the exact same reasons as elaborated in the previous model, dummy_core[A] appears twice in the table.

Table 3: regression results model 3 – “The Randstad”

Variables	β-Coefficient	Std. Error	T-test	Significance (p-value)
(constant)	8.407	2.303	3.650	0.000
	Agglomeration			
Dummy_core [A]	0.266	0.644	0.413	0.681
Dummy_core [B]	0.762	0.704	1.081	0.282
Dummy_suburban [A]	-0.496	0.651	-0.762	0.448
	Innovation climate			
HighEdu_LF	-0.020	0.023	-0.871	0.386
StudentsHE_LF	0.021	0.007	2.984	***0.004**
Micro_firms_LF	0.040	0.005	8.069	***0.000**
Dummy_UNI	-1.320	0.748	-1.766	****0.081**
	Demand and supply			
Pop_growth_0306	0.095	0.052	1.835	***0.070**
Density_2006	0.000	0.000	-1.231	0.221
Gdp_growth_0306	0.045	0.108	0.421	0.675
Gdp_capita	-0.264	0.117	-2.258	***0.026**
Unemployment_LF	0.490	0.111	4.431	***0.000**
Unemploy_growth	-0.350	0.135	-2.602	***0.011**
Immigrants_growth	0.052	0.052	0.997	0.321

Note: ([A]) denotes output from version A: dummy_core compared to dummy_rural; ([B]) denotes output from version B: dummy_core compared to dummy_suburban; (*) significant at 5% level; (**) significant at 10% level; statistical calculations done with SPSS.

The R-square for model 3 equals 0.562. This means that 56.2% of the variation in the dependent variable is explained by the independent variable in the model.

Agglomeration

In accordance to the hypothesis 3, for the Randstad, the dummies for agglomeration show no significant results. As such, the degree of agglomeration of municipalities in the Randstad seems to be of no influence on the number of business start-ups. Although both the core dummies show a positive β-Coefficient, these values are not significantly different from zero. The β-Coefficient for the suburban dummy is negative, and again this value is not significantly different from zero.

Therefore the positive influence of agglomeration on core municipalities in the Netherlands is not found in the Randstad.

Innovation climate

With respect to the indicators for the innovation climate, only the highly educated labour force shows no significant influence. The remaining indicators, on the other hand, do show significant influences on the number of business start-ups. The first significant indicator (p-value 0.004) is the variable representing students in higher education. With a β-Coefficient of 0.021 and a standard error of 0.007 this indicates a positive influence. A positive influence (β-Coefficient of 0.040, standard error of 0.005) can also be found for the variable representing the presence of micro firms. The p-value for this indicator is 0.000 which therefore shows a highly significant influence. Finally, the dummy concerning the presence of a university shows another significant effect on the number of business start-ups. Remarkable, however is the negative β-Coefficient of -1.320. This suggests that the presence of a university decreases the number of business start-ups for municipalities in the Randstad. What is remarkable is that the dummy university has a negative influence, whereas the presence of students in higher education has a positive influence. However, a moderate number of universities are present in the Randstad and are concentrated in the largest cities. The students on the other hand, can be residing in any particular municipality.

When comparing these results for both agglomeration and innovation climate, with the whole of the Netherlands (model 1), it is striking that in the Netherlands the degree of agglomeration shows positive influences on entrepreneurship, whereas in the Randstad these influences seem absent. With regards to the innovation climate, the situation seems the other way around. In the Netherlands as whole only micro firms show a significant influence, whereas for the Randstad all but highly educated labour force significantly influence the number of business start-ups.

Demand and supply

Compared to the previous two models, the same demand and supply factors show significant influences, however with the addition of growth in unemployment. Both population growth and unemployment show positive influences (β-Coefficient of 0.095 and 0.490 respectively) on business start-ups, whereas gdp per capita and unemployment growth show negative influences (β-Coefficient of -0.264 and -0.350 respectively). Noteworthy, is the opposite influence of unemployment on the one hand and unemployment growth on the other. This contradiction further elaborated upon in the discussion part of this chapter.

Assumptions

Skewness and kurtosis show values of 0.015 and 1.799 respectively and are thus within the critical values of -2 and 2, thus normality can be assumed. This can also be seen from the normality curve in the histogram. With regards to the tolerance of multicollinearity, the values for tolerance and VIF for dummy university are 0.205 and 4.875 respectively. However, these are still between the critical values 0.2 and 5. There is thus no reason for concern in this regard. All other values for each of the variables are also in between these critical values, indicating no problem of multicollinearity. The autocorrelation, measured by the Durbin-Watson statistic shows a value of 1.988, suggesting a slight positive correlation between the independent variables. This is, however, still between 1.5 and 2.5. Also, there seems to be no sign of heteroskedasticity, both the scatterplot (no pattern detectable) and the White's test ($nR^2<\chi^2 \rightarrow 102.3<124.3$) (Aczel & Sounderpandian 2002) confirms this. Concludingly, for the third model, based on the Randstad, the assumptions are met, and thus conclusions can be drawn from the results of model 3.

4.5 Results model 4: "The intermediate zone & periphery"

Table 4 shows the results for the intermediate zone and periphery. Again, dummy_core appears twice, once compared to dummy_rural (denoted by ^{A}) and once compared to dummy_suburban (denoted by ^{B}). The selection variable is now set to include observations in both the intermediate zone and the periphery, excluding the Randstad.

Table 4: regression results model 4 – "The intermediate zone & periphery"

Variables	β-Coefficient	Std. Error	T-test	Significance (p-value)
(constant)	3.633	2.192	1.658	0.099
	Agglomeration			
Dummy_core ^{A}	0.815	0.471	1.733	****0.084**
Dummy_core ^{B}	0.220	0.493	0.447	0.656
Dummy_suburban ^{A}	0.595	0.338	1.763	****0.079**
	Innovation climate			
HighEdu_LF	0.006	0.017	0.319	0.750
StudentsHE_LF	-0.004	0.003	-1.334	0.180
Micro_firms_LF	0.064	0.005	11.960	***0.000**
Dummy_UNI	1.074	0.510	2.105	***0.036**
	Demand and supply			
Pop_growth_0306	0.101	0.069	1.476	0.141
Density_2006	0.001	0.000	2.125	***0.035**
Gdp_growth_0306	-0.063	0.067	-0.948	0.344
Gdp_capita	-0.105	0.109	-0.962	0.337
Unemployment_LF	0.081	0.063	1.298	0.195
Unemploy_growth	0.029	0.086	0.331	0.741
Immigrants_growth	-0.048	0.044	-1.095	0.274

Note: (^{A}) denotes output from version A: dummy_core compared to dummy_rural; (^{B}) denotes output from version B: dummy_core compared to dummy_suburban; (*) significant at 5% level; (**) significant at 10% level; statistical calculations done with SPSS.

The R-square for model 4 equals 0.413. This means that 41.3% of the variation in the dependent variable is explained by the independent variable in the model.

Agglomeration

Both dummy_core[A] (β-Coefficient of 0.815, standard error of 0.471 and a p-value of 0.084) and dummy_suburban[A] (β-Coefficient of 0.595, standard error of 0.338 and a p-value of 0.079), show a positive and furthermore significant influence on the number of business start-ups compared to dummy_rural. This means that municipalities that are part of an urban agglomeration (both core and suburban) have relatively more business start-ups compared to rural municipalities. With regards to entrepreneurship this suggests that, as opposed to the Randstad, it does seem advantageous to be located within an urban agglomeration. This is in line to what was expected initially and hypothesized in chapter 2.6.

Within an agglomeration there is no difference in business start-ups between dummy_core and dummy_suburban, as the β-Coefficient for dummy_core[B] is 0.220 (standard error 0.493) and p-value is 0.656. This implies that there are no advantages of core municipalities compared to suburban municipalities in terms of agglomeration economies.

Innovation climate

In line with the results of three previous models, micro firms again has a positive (β-Coefficient of 0.064 and standard error of 0.005) and significant (p-value of 0.084) influence on business start-ups. Additionally, dummy university shows a positive ((β-Coefficient of 1.074, standard error 0.510) and significant (p-value 0.036) effect. Thus, both the presence of micro firms and the presence of university in an agglomeration positively influences the number of business start-ups. A main difference, compared to the Randstad, where the dummy university was also significant, is that it now shows a positive instead of a negative influence.

The high educated labour force as well as the students in higher education do not show significant results.

Demand and supply

The three variables that showed significant influences in the previous three models do not seem to have the same effect in the intermediate zone and periphery. First, population growth (β-Coefficient of 0.101, standard error of 0.069) shows a p-value of 0.141, and is thus not significant. Second, gdp per capita ((β-Coefficient of -0.105, standard error of 0.109) has a p-value of 0.337 and is therefore also not significant. Finally, unemployment has a β-Coefficient of 0.081 (standard error of 0.063) and a p-value of 0.195 and also does not show a significant result.

Population density, on the other hand (in contrast to the previous three models) does show a positive (β-Coefficient of 0.001, standard error 0.000) and significant result (p-value of 0.035). This suggests that municipalities with a higher population density have a higher number of business start-ups. This result confirms the importance (with respect to business start-ups) of agglomerations in the intermediate zone & periphery.

Assumptions

For model 4 skewness shows a value of -0.540 and kurtosis shows values of 2.305. The skewness is within the critical value of -2 and 2. However, the kurtosis is larger than 2, indicating pointyness with regards to the normal distribution. This is also visible in the histogram. Due to the sufficiently large degrees of freedom (df=371) which is larger than 20, it does not pose a threat. Thus, normality is assumed. With regards to the tolerance of multicollinearity, all values are above 0.2 and the VIF values are all below 5, indicating no problem of multicollinearity. The autocorrelation, measured by the Durbin-Watson statistic shows a value of 2.081, suggesting a slight negative correlation between the independent variables. This is, however, still between 1.5 and 2.5, so there is no reason for concern with regards to autocorrelation. Finally, heteroskedasticity is considered. Both the scatterplot (no pattern detectable) and the White's test ($nR^2<\chi^2 \rightarrow 107.27<124.3$) (Aczel & Sounderpandian 2002) show no sign of hetereoskedasticity. As such, for the fourth model, the assumptions are met, and thus conclusions can be drawn from the results of model 4.

After running all of the discussed models, the significant results are combined in table 5 in the next chapter, giving an overview of the significancy of every variable and for each model. This way, per model (columns) one can clearly see which variables (rows) are significant.

5. DISCUSSION AND LIMITATIONS

The empirical results shown in the previous chapter will now interpreted and elaborated upon. The results are compared to what was hypothesized based on the theoretical framework in this thesis. Table 5 provides an overview of the final results from the empirical research, displaying for each of the determinants of entrepreneurship what the effects are within different regions within the Netherlands. Positive significant results are indicated by ´X´, whereas negative significant results are indicated by '(X)'.

This chapter will review each model (G4-G27, The Netherlands, the Randstad and the intermediate zone & periphery) with respect to the determinants of entrepreneurship (agglomeration, innovation climate and demand and supply).

Table 5: overview of results

Variables	G4-G27	NL	Randstad	Interm. zone & periphery
Agglomeration				
Dummy_G4^{A}		n/a	n/a	n/a
Dummy_G4^{B}		n/a	n/a	n/a
Dummy_G27^{A}	**X**	n/a	n/a	n/a
Dummy_core^{A}	n/a	**X**		**X**
Dummy_core^{B}	n/a	**X**		
Dummy_suburban^{A}	n/a			**X**
Innovation climate				
HighEdu_LF				
StudentsHE_LF			**X**	
Micro_firms_LF	**X**	**X**	**X**	**X**
Dummy_UNI			**(X)**	**X**
Demand and supply				
Pop_growth_0306	**X**	**X**	**X**	
Density_2006				**X**
Gdp_growth_0306				
Gdp_capita	**(X)**	**(X)**	**(X)**	
Unemployment_LF	**X**	**X**	**X**	
Unemploy_growth			**(X)**	
Immigrants_growth				

Note: 'X' implies a significant and positive results; '(X)' implies a significant and negative result.

5.1 Agglomeration

G4-G27

With regards to agglomeration, the influence of city size on the number of business start-ups has first been investigated. This has been done by using the G4-G27 division, representing the four largest

Dutch cities (G4), the 27 large cities (G27) and the small municipalities (grouped as non-g in this thesis). Table 5 shows no significant difference for the four largest cities compared to the 27 large and the non-g municipalities. Thus, hypothesis 1.a and 1.b, stating that G4 has more business start-ups compared to G27 and small municipalities cannot be accepted. A possible explanation for the absence of a significant influence of the G4 on the number of business start-ups is the presence of diseconomies of agglomeration in the four largest cities as suggested in the literature. The variables used in this model, however, are unable to detect such diseconomies. Therefore, to draw such a conclusion further research needs to be conducted.

The G27 municipalities, on the contrary, are found to have significantly more business start-ups than the small municipalities. This is in accordance to hypothesis 1.c, stating that G27 have a higher number of business start-ups compared to small municipalities. These cities are not as big as the G4 municipalities and therefore, the significant influence on business start-ups compared to small municipalities suggest that the agglomeration economies outweigh the diseconomies, if these diseconomies are present at all.

The Netherlands

Based on the theoretical framework in chapter 2, it has been hypothesized that for the Netherlands the degree of agglomeration has a positive effect on the number of business start-ups. Reviewing the results from chapter 4, summarized in table 5, it shows that core municipalities have a higher number of business start-ups compared to suburban and rural municipalities. Therefore, hypothesis 2.a and hypothesis 2.b, stating that core municipalities have more business start-ups compared to suburban and rural, can be accepted. No evidence was found that suburban municipalities have more business start-ups compared to rural municipalities. As such, hypothesis 2.c cannot be accepted.

Concludingly, this means that the degree of agglomeration does influence the number of business start-ups in the Netherlands, however only for the highest degree (core) of agglomeration. This suggests that agglomeration effects are present, and these environments are favourable for entrepreneurs. In contrary to the results regarding the G4-G27 model, the agglomeration economies appear to outweigh the diseconomies. These contradicting findings (that the highest degree of agglomeration influences business start-ups for the Netherlands model, while it does not in the G4-G27) can be explained by differences between the Randstad on the one hand and the intermediate zone & periphery on the other. These differences are elaborated upon later on in this chapter.

Suburban municipalities, which were expected to benefit from these agglomeration economies, fail to show a significant effect. In the Netherlands, out of all degrees of agglomeration, the core municipality is the most favourable to entrepreneurs (showing the highest relative number of business start-ups). With respect to entrepreneurship there seems no difference between suburban and rural municipalities.

A possible explanation for this is the way the degree of agglomeration has been determined. This has been done by means of the number of in and out commuting employees between municipalities. By doing so, the interdependency has been distinguished. However it can also imply that the employees who already commute to a core decide to start their business in that core, as opposed to the municipality of their residence. This can be due to the presence of networks and relationships, which are centralized in the core municipality, emphasizing the importance of the core region. Furthermore, it could suggest that agglomeration economies decrease over distance. For example, knowledge could spillover to a nearby municipality through employment mobility. However, other agglomeration economies might not be so mobile and therefore it could be essential to establish a firm in a core region. By only taking into account employment, and more specifically commutement between municipalities, as a measure for the degree of agglomeration other factors might be overlooked. As such, employment by itself, leaving out possible other important factors could bias the result.

The Randstad

Due to high density it is expected that within the Randstad region agglomeration effects are present in any municipality. Therefore, the degree of agglomeration for a particular municipality should not be of influence on the number of business start-ups. This is also proposed in hypothesis 3a to 3c. The empirical results show the following: there are indeed (as hypothesized) no significant differences between core, suburban and rural municipalities with respect to the relative number of business start-ups. This means the entire hypotheses 3 (including the sub hypotheses) can be accepted. Even though the results are as expected, it is remarkable that, compared to the Netherlands as a whole, it does not seem to matter for an entrepreneur where to establish. When comparing these results to the G4-G27 model, consistencies can be distinguished. In the current model (Randstad), core regions do not show significant more business start-ups compared to municipalities with a different degree of agglomeration. This is consistent to G4, which comprises the four largest core municipalities within the Randstad. These four municipalities also do not show a significant higher business start-up rate. A possible explanation for these results is the spread of agglomeration economies through the Randstad. These economies are present in the area, however, they are not bounded by the borders of the agglomerations (as proposed in hypothesis 3). Entrepreneurs benefit from these externalities irrespective of their location within the Randstad. Another possible explanation is the presence of diseconomies of agglomeration within both the G4 in model 1 and the agglomerations of the current model. As diseconomies can render a location less attractive, this could negatively influence the number of business start-ups. The current study does not incorporate measures for diseconomies of agglomeration (such as congestion, pollution and increased rent), thus, it is not possible to identify whether this is caused by these diseconomies or the suggested evenly spread economies throughout the Randstad.

The intermediate zone & periphery

The intermediate zone and periphery are characterized by relatively lower density. The expectation here is that, in contrast to what is seen within the Randstad, the degree of agglomeration does influence the number of business start-ups. For the area at hand, table 5 shows that both core and suburban have significantly more business start-ups compared to rural. Hypothesis 4.a and 4.c, stating that core and suburban have more business start-ups than rural, therefore can be accepted. Hypothesis 4.b however, stating that core municipalities have more business start-ups than suburban, is found not to be significant. This means that core and suburban show no differences with one another, but compared to rural they do. Concludingly, agglomerations (consisting of core and suburban municipalities) provide positive externalities and favour entrepreneurship.

After reviewing all four models, the following consistencies can be distinguished regarding agglomeration and its effect on entrepreneurship. To start, the outcomes suggest that higher degrees of agglomeration positively influence the number of business start-ups, however, with the exception of the G4 and the Randstad. The four largest cities in the Netherlands (G4) are all located within the Randstad and furthermore are all classified as core locations. The results for the G4-G27 on the one hand and the Randstad model on the other are consistent. Highly agglomerated areas (either being G4 or core municipalities located in the Randstad), show no significant differences in business start-ups. This could be explained by the density of the area or the diseconomies present in highly agglomerated areas. As the G27 municipalities are spread more even across the country, and are also classified mainly as core municipalities, the significant difference with respect to small municipalities, is consistent with the expectations. Core municipalities throughout the country, with the exception of the Randstad, display significantly more business start-ups compared to rural emphasizing the effect of the degree of agglomeration on entrepreneurship.

5.2 Innovation climate

The indicators for an innovation climate are hypothesized in hypothesis 5.a to 5.d and are included in all four models. Therefore, for every model, these sub hypotheses are tested and are reviewed separately.

G4-G27

Within the G4-G27 model the indicators for an innovation climate include high educated labour force, students in higher editions, presence of micro firms and presence of a university. High levels of these indicators (for university this means present or not) imply higher levels of an innovation climate. As such, the hypotheses in chapter 2.6 propose a positive influence of each of these indicators on the number of business start-ups for all models (G4-G27, The Netherlands, The Randstad and The intermediate zone & periphery). Thus, for the G4-G27 model, hypotheses 5.a to 5.d reflect these positive influences of the indicators, as it does for all the other models. First, the relative number of the higher educated labour force shows no significant result, as shown in table 5. This means that hypothesis 5.a cannot be accepted. Second, the variable for the relative number of students in higher education also shows no significant influence on business start-ups, meaning that hypothesis 5.b cannot be accepted. Third, with respect to hypothesis 5.d the presence of a university also does not seem to influence the number of business start-ups. Consequently, hypothesis 5.d cannot be accepted. Finally, hypothesis 5.c, stating that the presence of micro firms has a positive influence on the number of business start-ups, can be accepted. The presence of micro firms shows a positive and significant effect on business start-ups. This means the higher the number of micro firms in a municipality, the higher the relative number of business start-ups is found.

The Netherlands

For the model regarding the Netherlands, the same innovation climate indicators are included, as used in the model for G4-G27. Furthermore, the proposed sub hypotheses (of hypothesis 5) reflect the expected positive influences of these indicators on the number of business start-ups in the Netherlands. The results, as shown in table 5, are consistent with the results of the G4-G27 model, described above. This means that the proportion of the highly educated labour force does not influence business start-ups. Thus, hypothesis 5.a cannot be accepted for this model. The variable regarding hypothesis 5.b, reflecting the positive influence of the number of students in higher education, shows no significant influence, meaning that the hypothesis cannot be accepted. The same goes for hypothesis 5.d, the presence of a university has no influence on business start-ups. Hypothesis 5.c however, can be accepted. Micro firms in this model show a positive and significant effect on business start-ups.

The Randstad

Within the Randstad, different results are retrieved concerning the effect of the indicators of an innovation climate on business start-ups. Again, the same indicators apply for this model as hypothesized in 5.a to 5.b. High educated labour force shows no significant results, therefore hypothesis 5.a cannot be accepted. However, the variable for the relative number of students in higher education does show significant results, meaning that hypothesis 5.b can be accepted. Also, as seen in the previous models (G4 and the Netherlands), the presence of micro firms show a positive and significant influence. Therefore, hypothesis 5.c can be accepted. Finally, the presence of a university also shows a significant result, yet the influence is negative. Hypothesis 5.d however, proposed a positive influence. Instead a negative influence has resulted. Therefore, this hypothesis cannot be accepted.

Concludingly, in the Randstad the innovation climate seems of much greater importance, as opposed to the model of G4-G27 and the Netherlands. Three out of four indicators show significant influences on the relative number of business start-ups in the Randstad. When comparing these results with the Netherlands, it shows that for the Randstad, students in higher education do have a positive and significant effect on business start-ups, whereas in the model for the Netherlands, it is positive but not significant. Apparently, in the Randstad, entrepreneurship benefits from the presence of students in higher education, whereas in the Netherlands it does not.

The main contradiction in these results is the positive influence of student in higher education on the one hand and the negative influence of the presence of a university on the other. However, the presence of a university is an indication for the concentration of knowledge, whereas the number of student suggests the diffusion or spillover of knowledge. A possible explanation for the negative influence of the university presence is that there are only a limited number of universities in the Randstad. In the Randstad there are only 6 municipalities with the presence of a university. The presence of a university is expected to create knowledge spillovers flowing from this university, possibly through spin-offs. However, as universities are mainly concerned with relatively generic and basic science, this might not be the ideal pool for (potential) entrepreneurs. However, this does not explain the negative effect.

The intermediate zone & periphery

Again, for the intermediate zone & periphery, hypotheses 5.a to 5.d have been tested. The results in table 5 show different results compared to the previous models. The G4-G27 and the Netherlands only found significant positive influence of the presence of micro firms. In addition to micro firms, The Randstad found positive effects of students in higher education and a negative effect for the presence of a university. For the intermediate zone & periphery, the presence of micro firms is also found to be positively significant, the proportion of student in higher education seems to have no influence, as does the proportion of the highly educated labour force. However, as hypothesized, in this model the presence of a university does seem to have a positive influence on the relative number of business start-ups. This is in contrast to the relationship between university presence and business start-ups witnessed in the Randstad. Universities are likely to be sources of knowledge spillovers, creating an innovative climate and thus stimulating entrepreneurial start-ups.

Now that all models have been reviewed, one can conclude that the proportion of the highly educated labour force does not show a significant influence on the number of start-ups. Micro firms, show positive significant and robust influences on business start-ups regardless of the model used. This is thus a strong indicator for the presence of an innovation climate. However, by means of regression analysis it is not possible to conclude on causal relationships, only correlations between dependent and independent variables can be determined. The problem with micro firms however, is that intuitively, starting firms are often small and therefore belong to the group of micro firms. As such, it is hard to determine whether micro firms lead to more business start-ups or business start-ups lead to more micro firms. However, the variable micro firms used in this dataset is relative to the labour force to correct for this. In order to determine the causal relationship, time series data is required.

Initially, to grasp the concept of innovation and more specifically, the innovation climate, a factor variable was created through factor analysis, incorporating the used indicators (that were ultimately entered separately). However the explanatory value of the model was extremely low and furthermore significant results did not appear. In search of other variables to indicate innovation, three other variables have been tested. These variables where created by Raspe et al. (2004) in their paper on knowledge in the Netherlands, as discussed in the literature review. The authors constructed these variables by using factor analysis. The three resulting factors are "R&D", "Innovation" and "Knowledge workers". These factors consist of multiple indicators. The regressions in this thesis have also been run with these three factors (results not included). However, the outputs did not show any significant results. Thus, our initial factor and the factors created by Raspe et al. (2004) do not exhibit any significance. Moreover, some variables showed negative influences (albeit not significant), which is also counter intuitive. Reasons for this insignificance could be either that innovation, or more specifically the innovation climate, does not have an influence on the number of business start-ups. However, theoretically, this is not supported. As such, the factors used, might not be a good indicator for the presence of an innovation climate. The choice of the used indicators for the innovation climate is unfortunately constraints by the availability of data, especially on municipal level. Ideally, the concept of innovation climate, and more specifically the effect it has on business start-ups, could be approached more accurately, if additional municipal level data was available. These could include data on R&D expenditures, patents or extensive and elaborate questionnaires regarding innovations. Some of this data is available, however, this is often on a higher aggregate level (e.g. national or COROP level). By using these data, either assumptions would have to be made that every municipality within the region has the same level of the variable concerned, or one would have to divide the variable by use of some location quotient. Nonetheless, both ways would not show accurate municipal estimations and were therefore left out of consideration.

5.3 Demand and supply

The demand and supply factors were used as control variables in the models and are thus not hypothesized, however discussing these variables could give a richer understanding regarding the differences in business start-ups between municipalities. The results show consistencies over all researched models, with the exception of the intermediate zone and periphery.

To start, population growth has a positive and significant influence on the business start-ups per municipality. This indicates that an increase in the population can increase both the demand for entrepreneurial products, as well the supply of potential entrepreneurs.

Furthermore, the gdp per capita shows a significant but negative influence on business start-ups. This might be because a high gdp per capita could imply that the wages for employment are high, which increases the opportunity costs for entrepreneurship. Nascent entrepreneurs could therefore postpone the decision to engage in entrepreneurial activity. Moreover, high wages imply that it is more expensive to hire employees, which can increase the costs for setting up a new business. The results of these models suggest therefore that these negative supply effects outweigh the positive effects, such as increased demand and access to capital.

Unemployment has positive and significant effects on business start-ups. This can be due to increased supply of (necessity) entrepreneurs, in which more people are forced into self-employment. For the Randstad, unemployment growth has a negative and significant influence on the number of business start-ups. This increase in unemployment decreased the demand for products and services. Furthermore, similar to the effects of a high gdp, opportunity costs for nascent entrepreneurs increase. When the newly started firm fails, it can be more difficult to find a new job when unemployment is high. Due to this risk potential entrepreneurs might postpone their decision to become self-employed.

Finally, population density positively influences the number of business start-ups in the intermediate zone, as opposed to the other models (G4-G27 and The Randstad). A reason for this could be that the G4 and the Randstad are already highly dense and as such density might not be an additional advantage. Furthermore, the effects of population density in the intermediate zone & periphery is consistent with the positive effect of urban agglomeration in this macro zone.

6. CONCLUSIONS

The domain of this thesis lies within entrepreneurship and space, more precisely how the relative number of business start-ups differs between urban municipalities and rural municipalities in the Netherlands. The differences in business start-ups between municipalities is attempted to be explained by focussing on the degree of agglomeration and an innovation climate. Furthermore, due to the contrast between the Randstad and the peripheral area, in terms of population density and concentration of economic activity, differences are expected between these regions with respect to the above mentioned degree of agglomeration and innovation climate. Therefore, the macro zones were researched separately, to ultimately compare them to one another. To do so, this thesis started with the following main research question: Does the degree of agglomeration of municipalities in the Netherlands, and the corresponding innovation climate of that municipality, have effects on entrepreneurship (i.e. the number of business start-ups) in that municipality and are these effects different between macro zones in the Netherlands?

After reviewing and discussing the results from the regression analysis, the proposed research question can be addressed. Overall, the degree of agglomeration in the Netherlands has positive effects on the number of start-ups in a municipality. Municipalities labelled as core, which is the highest degree of agglomeration, has significantly more business start-ups compared to other municipalities. This emphasizes the positive effect of agglomeration economies on entrepreneurship in the Netherlands.

When the Netherlands is divided in both the Randstad on the one hand and the intermediate zone and the periphery on the other, differences in effects emerge. The most remarkable finding from this research is that, even though agglomeration economies are presumably present in the Randstad and (positively) affect business start-ups, these externalities are more spread across the whole Randstad in stead of being confined to a particular agglomeration. This could be due to the high density and concentration of urban agglomerations within the Randstad compared to the less urbanized intermediate zone and the periphery. Thus, in the Randstad it is of less importance for entrepreneurs to be located within an agglomeration to benefit from the externalities.

Contrarily, in the intermediate zone and the periphery, location is of great importance. There are significantly more entrepreneurs in all agglomerated areas compared to the rural municipalities. This emphasizes the importance of the degree of agglomeration on entrepreneurship in peripheral areas of the Netherlands

The remaining and final element of the main research question, regards the effect of the innovation climate of a municipality on entrepreneurship. To grasp the concept of the innovation climate, several indicators for such a climate have been incorporated in the research. One of these indicators shows a positive and consistent effect on entrepreneurship, namely a high presence of micro firms in a municipality. The remaining indicators, however, show inconsistent and predominantly non significant results. As such, the results fail to show a consistent significant relationship between innovation climate and entrepreneurship. Therefore, one could conclude that an innovation climate, as measured in this thesis, does not affect entrepreneurship. However, this is not supported theoretically and thus might be to simplistic. Additional indicators could approach the effect of an innovation climate more precisely. However, due to data availability constraints, no additional indicators were used. Therefore, the results of the model used in this research provide insufficient evidence on the effects of an innovation climate on entrepreneurship. Additional research consisting of a richer approach to innovation or an innovation climate (possibly containing more indicators) would have to determine the effects on entrepreneurship.

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APPENDIX A

VARIABLES DATASET

Variable	Description
- Dummy_G4	- Municipalities that are one of G4 municipalities
- Dummy_G27	- Municipalities that are one of G27 municipalities
- Dummy_NonG	- Municipalities that are not part of G4 or G27
- Dummy_core	- Core municipalities (agglomeratie index Van Oort) are 1, rest is 0
- Dummy_suburban	- Suburban municipalities (agglomeratie index Van Oort) are 1, rest is 0
- Dummy_rural	- Rural municipalities (agglomeration index Van Oort) are 1, rest is 0
- StartupsLF	- Number of business start-ups per 1000 labour force per municipality
- Unemployment_LF	- Share of unemployed labour force as a ratio of the total labour force per municipality
- Unemploy_growth	- Unemployment growth between 2003 and 2006
- Immigrants_growth	- Immigrants growth between 2004 and 2006
- Density_2006	- Population density in 2006 per municipality
- Pop_growth_0306	- Population growth between 2003 and 2006 per municipality
- Gdp_growth_0306	- GDP per capita growth between 2003 and 2006 per municipality
- HighEdu_LF	- High educated share of labour force as a ratio of the labour force
- StudentsHE_LF	- Students in higher education as a ratio of the labour force
- Micro_firms_LF	- Relative number of small firms (<10 employees) as a ratio of the labour force
- Dummy_UNI	- Municipalities that have a university are 1, rest is 0
- GDP_capita	- The GDP per capita per municipality

APPENDIX B

MODEL I:

Used for "G4-G27" (model 1).

Dependant variable (ENTREPRENEURSHIP)	Independent variable (AGGLOMERATION & INNOVATION CLIMATE)	Control variables (DEMAND AND SUPPLY FOR ENTREPRENEURSHIP)
No. of business start-ups as a ratio of the labour force	*Dummy G4*	*Unemployment as a ratio of the labour force per municipality*
	Dummy G27	*Unemployment growth between 2003 to 2006 per municipality*
	Dummy NonG	*GDP growth from 2003 to 2006 per capita/municipality*
	High educated share of labour force as a ratio of the labour force	*Population density 2006 per municipality*
	Students in higher education as a ratio of the labour force	*Population size 2006 per municipality*
	Relative number of small firms (<10 employees) as a ratio of the labour force	*Population growth from 2003 to 2006 per municipality*
	Dummy University	*Immigrants growth from 2004 to 2006 per municipality*

Note: All variables concern data on municipality level.

MODEL II:

Used for “The Netherlands” (model 2), “The Randstad” (model 3) and “The intermediate zone & periphery” (model 4).

Dependant variable **(ENTREPRENEURSHIP)**	**Independent variable** **(AGGLOMERATION & INNOVATION CLIMATE)**	**Control variables** **(DEMAND AND SUPPLY FOR ENTREPRENEURSHIP)**
No. of business start-ups as a ratio of the labour force	*Dummy Core*	*Unemployment as a ratio of the labour force per municipality*
	Dummy Suburban	*Unemployment growth between 2003 to 2006 per municipality*
	Dummy Rural	*GDP growth from 2003 to 2006 per capita/municipality*
	High educated share of labour force as a ratio of the labour force	*Population density 2006 per municipality*
	Students in higher education as a ratio of the labour force	*Population size 2006 per municipality*
	Relative number of small firms (<10 employees) as a ratio of the labour force	*Population growth from 2003 to 2006 per municipality*
	Dummy University	*Immigrants growth from 2004 to 2006 per municipality*

Note: All variables concern data on municipality level.

APPENDIX C

REGRESSION RESULTS AND ASSUMPTIONS

This appendix comprises of the outputs that are concerned with the regression results and the assumptions of each of the four regression models (G4-G27, the Netherlands, the Randstad, and the intermediate zone & the periphery) and is structured as such. Each section covers consecutively the *regression results & multicollinearity, autocorrelation & R-square, normality* and *heteroskedasticity*.

1. G4-G27

Regression results & multicollinearity

A: dummy_G4/dummy_g27

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	6.624	1.413		4.688	.000		
	Dummy_G4	1.538	1.062	.067	1.448	.148	.810	1.234
	Dummy_G27	.901	.434	.099	2.079	.038	.768	1.301
	HighEdu_LF	.006	.014	.028	.417	.677	.394	2.537
	StudentsHE_LF	.001	.003	.037	.521	.602	.351	2.851
	Micro_Firms_LF	.050	.004	.641	13.516	.000	.777	1.288
	Dummy_UNI	.041	.359	.007	.113	.910	.420	2.381
	Pop_growth_0306	.084	.043	.083	1.951	.052	.963	1.038
	Density_2006	1.013E-5	.000	.004	.081	.935	.644	1.552
	Gdp_growth_0306	-.032	.059	-.027	-.536	.593	.674	1.483
	GDP_capita	-.168	.073	-.136	-2.298	.022	.499	2.005
	Unemployment_LF	.124	.054	.116	2.285	.023	.681	1.469
	Unemploy_growth	-.057	.076	-.035	-.760	.448	.818	1.222
	Immigrants_growth	-.032	.034	-.040	-.936	.350	.945	1.058

a. Dependent Variable: StartupsLF

B: dummyG4_dummy_NonG

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	7.526	1.428		5.272	.000		
	Dummy_G4	.637	1.060	.028	.601	.548	.813	1.229
	Dummy_NonG	-.901	.434	-.106	-2.079	.038	.677	1.477
	HighEdu_LF	.006	.014	.028	.417	.677	.394	2.537
	StudentsHE_LF	.001	.003	.037	.521	.602	.351	2.851
	Micro_Firms_LF	.050	.004	.641	13.516	.000	.777	1.288
	Dummy_UNI	.041	.359	.007	.113	.910	.420	2.381
	Pop_growth_0306	.084	.043	.083	1.951	.052	.963	1.038
	Density_2006	1.013E-5	.000	.004	.081	.935	.644	1.552
	Gdp_growth_0306	-.032	.059	-.027	-.536	.593	.674	1.483
	GDP_capita	-.168	.073	-.136	-2.298	.022	.499	2.005
	Unemployment_LF	.124	.054	.116	2.285	.023	.681	1.469
	Unemploy_growth	-.057	.076	-.035	-.760	.448	.818	1.222
	Immigrants_growth	-.032	.034	-.040	-.936	.350	.945	1.058

a. Dependent Variable: StartupsLF

Autocorrelation & R-square

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.611	.374	.351	1.90197	1.908

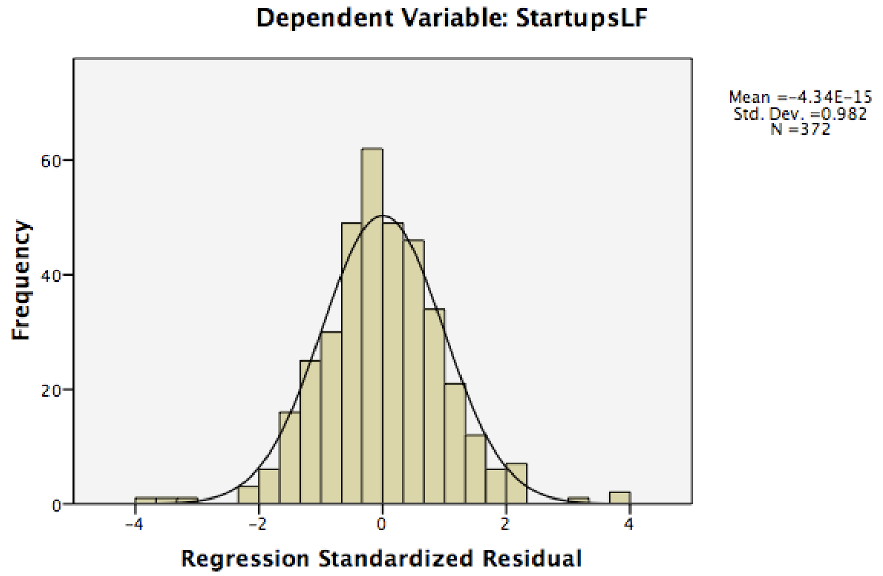
a. Predictors: (Constant), Immigrants_growth, StudentsHE_LF, Pop_growth_0306, Unemployment_LF, Dummy_G4, Micro_Firms_LF, Dummy_G27, Unemploy_growth, GDP_capita, Gdp_growth_0306, Density_2006, Dummy_UNI, HighEdu_LF

b. Dependent Variable: StartupsLF

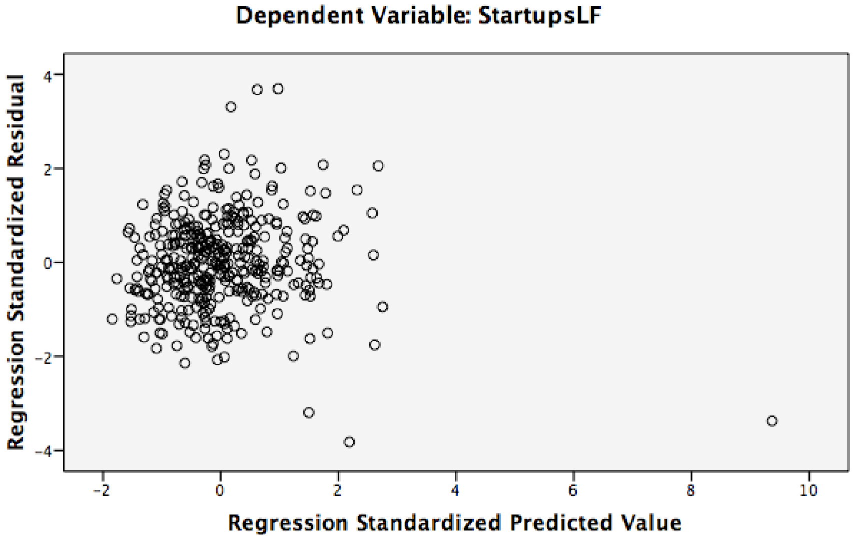
Normality

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Standardized Residual	372	-3.82195	3.69590	.0000000	.98232356	.095	.126	1.520	.252
Valid N (listwise)	372								



Heteroskedasticity



Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.582	.338	.120	6.10260

a. Predictors: (Constant), G27_StudentHE_LF, SQ_POPgrowth, UnemploymentGrowth_GDPGrowth, G4_UnemploymentGrowth, GDPGrowth_StudentHO, SQ_IMMIGRANT_Growth, sq_Micro_BB, G4_POPGrowth, POPGrowth_ImmigrantGrowth, G27_ImmigrantGrowth, Unemployment_GDP, GDPGrowth_ImmigrantGrowth, G27_POPGrowth, Density2006_GdpGrowth, sq_unemploy_growth, UnemploymentGrowth_UNI, GDP_capita, UnemploymentGrowth_POPGrowth, Density2006_UNI, SQ_GDPGrowth, G27_UnemploymentGrowth, UnemploymentGrowth_ImmigrantGrowth, POPGrowth_StudentHO, Density2006_ImmigrantGrowth, HighEdu_LF, UNI_ImmigrantGrowth, UnemploymentGrowth_Density2006, G27_GDPGrowth, GDPGrowth_UNI, G27_UNI, G4_ImmigrantGrowth, POPGrowth_Bevoldichtheid, POPGrowth_UNI, G4_UNI, Unemployment_ImmigrantGrowth, Unemployment_StudentHO, POPGrowth_GDPGrowth, Unemployment_unemployGrowth, G27_Density2006, UnemploymentGrowth_StudentHO, sqBevoldichtheid2006, Unemployment_GDPGrowth, Unemployment_POPGrowth, StudentHE_LF_ImmigrantGrowth, UnemploymentGrowth_Micro, sq_StudentenHO, Density2006_StudentHO, HighEdu_LF_ImmigrantGrowth, Micro_Firms_LF, Micro_UNI, Unemployment_bevoldichtheid2006, UnemploymentGrowth_HoogOpBB, GDPGrowth_HoogOpBB, Micro_ImmigrantGrowth, G27_Micro, sqUnemploy, POPGrowth_Micro, Unemployment_UNI, Unemployment_HoogopBB, sq_HoogopgeleideBB, POPGrowth_HoogOpBB, Density2006_Micro, Unemployment_MicroFirms, G27_Unemployment, Gdp_growth_0306, GDP_StudentHO, Immigrants_growth, StudentHE_LF_UNI, Density2006_HoogOpBB, HighEdu_LF_Micro, Unemploy_growth, G27_HighEdu_LF, POPGrowth_GDP, Density_2006, HighEdu_LF_UNI, GDPGrowth_Micro, sq_GDP, StudentHE_LF_Micro, UnemploymentGrowth_GDP, SQ_G27, GDP_ImmigrantGrowth, SQ_UNI, GDPGrowth_GDP, HighEdu_LF_StudentHO, Pop_growth_0306, GDP_UNI, Unemployment_LF, Density2006_GDP, GDP_Micro, GDP_HoogOpBB, StudentsHE_LF, G27_GDP

b. Dependent Variable: SQresG4a

Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-6.1864	40.9692	3.4814	3.78523	372
Residual	-10.01224	43.50275	.00000	5.29213	372
Std. Predicted Value	-2.554	9.904	.000	1.000	372
Std. Residual	-1.641	7.129	.000	.867	372

a. Dependent Variable: SQresG4a

2. The Netherlands

Regression results & multicollinearity

A: dummy_core/dummy_suburban

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	6.906	1.404		4.919	.000		
	Dummy_core	1.001	.390	.133	2.565	.011	.649	1.541
	Dummy_suburban	.139	.299	.028	.467	.641	.479	2.086
	HighEdu_LF	.004	.014	.021	.306	.759	.382	2.619
	StudentsHE_LF	.001	.003	.022	.315	.753	.346	2.889
	Micro_Firms_LF	.050	.004	.644	13.450	.000	.760	1.316
	Dummy_UNI	.113	.382	.020	.297	.767	.371	2.699
	Pop_growth_0306	.086	.043	.085	1.983	.048	.955	1.047
	Density_2006	2.182E-5	.000	.009	.181	.857	.688	1.453
	Gdp_growth_0306	-.015	.059	-.013	-.256	.798	.678	1.474
	GDP_capita	-.189	.072	-.153	-2.610	.009	.510	1.962
	Unemployment_LF	.128	.054	.120	2.386	.018	.692	1.445
	Unemploy_growth	-.055	.076	-.034	-.727	.467	.814	1.228
	Immigrants_growth	-.034	.034	-.043	-1.004	.316	.942	1.061

a. Dependent Variable: StartupsLF

B: dummy_core/dummy_rural

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	7.046	1.461		4.823	.000		
	Dummy_core	.862	.401	.114	2.147	.032	.614	1.630
	Dummy_rural	-.139	.299	-.029	-.467	.641	.438	2.285
	HighEdu_LF	.004	.014	.021	.306	.759	.382	2.619
	StudentsHE_LF	.001	.003	.022	.315	.753	.346	2.889
	Micro_Firms_LF	.050	.004	.644	13.450	.000	.760	1.316
	Dummy_UNI	.113	.382	.020	.297	.767	.371	2.699
	Pop_growth_0306	.086	.043	.085	1.983	.048	.955	1.047
	Density_2006	2.182E-5	.000	.009	.181	.857	.688	1.453
	Gdp_growth_0306	-.015	.059	-.013	-.256	.798	.678	1.474
	GDP_capita	-.189	.072	-.153	-2.610	.009	.510	1.962
	Unemployment_LF	.128	.054	.120	2.386	.018	.692	1.445
	Unemploy_growth	-.055	.076	-.034	-.727	.467	.814	1.228
	Immigrants_growth	-.034	.034	-.043	-1.004	.316	.942	1.061

a. Dependent Variable: StartupsLF

Autocorrelation & R-square

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.613	.376	.354	1.89836	1.917

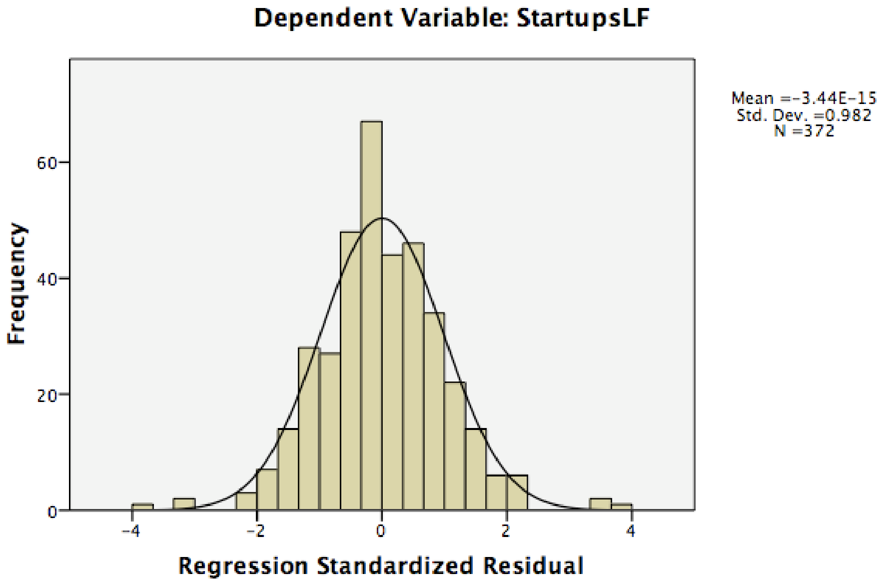
a. Predictors: (Constant), Immigrants_growth, StudentsHE_LF, Pop_growth_0306, Unemployment_LF, Density_2006, Micro_Firms_LF, Unemploy_growth, Dummy_core, GDP_capita, Gdp_growth_0306, Dummy_suburban, HighEdu_LF, Dummy_UNI

b. Dependent Variable: StartupsLF

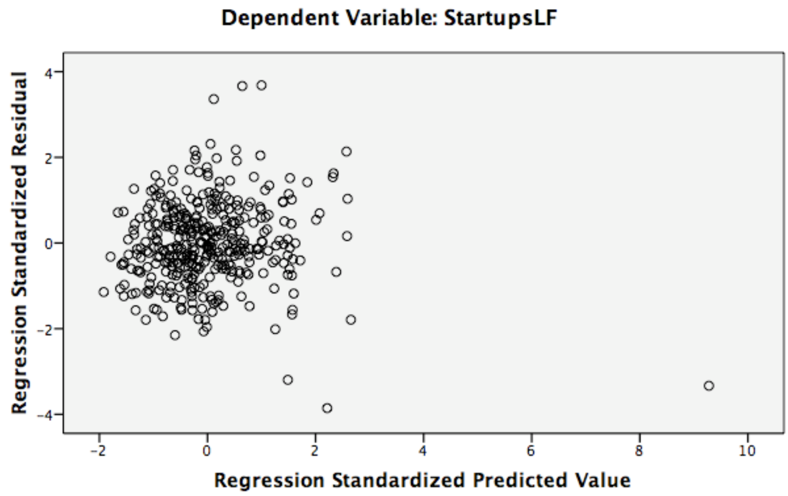
Normality

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Standardized Residual	372	-3.85512	3.68282	.0000000	.98232356	.095	.126	1.517	.252
Valid N (listwise)	372								



Heteroskedasticity



Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.570	.325	.075	5.96414

a. Predictors: (Constant), UNI_ImmigrantGrowth, sqUnemploy, GDP_StudentHO, POPGrowth_ImmigrantGrowth, Density2006_GdpGrowth, CORE_ImmigrantGrowth, UnemploymentGrowth_GDPGrowth, SQ_POPgrowth, sq_Micro_BB, POPGrowth_Core, SQ_GDPGrowth, CORE_UNI, sq_unemploy_growth, Density2006_SUBURBAN, GDPGrowth_ImmigrantGrowth, UnemploymentGrowth_POPGrowth, UnemploymentGrowth_UNI, UnemploymentGrowth_CORE, UnemploymentGrowth_ImmigrantGrowth, sq_GDP, GDPGrowth_Core, POPGrowth_StudentHO, GDPGrowth_Suburban, Density2006_ImmigrantGrowth, HighEdu_LF_Micro, UnemploymentGrowth_Density2006, GDPGrowth_UNI, SQ_IMMIGRANT_Growth, POPGrowth_Bevoldichtheid, Unemployment_GDPGrowth, UnemploymentGrowth_SURURBAN, POPGrowth_GDPGrowth, Density2006_CORE, POPGrowth_UNI, Unemployment_ImmigrantGrowth, Unemployment_SUBURBAN, SUBURB_ImmigrantGrowth, Density2006_UNI, StudentHE_LF_CORE, UnemploymentGrowth_StudentHO, POPGrowth_Suburban, Unemployment_POPGrowth, Unemployment_unemployGrowth, sqBevoldichtheid2006, Unemployment_UNI, StudentHE_LF_ImmigrantGrowth, Unemployment_HoogopBB, GDPGrowth_StudentHO, Unemployment_CORE, UnemploymentGrowth_Micro, HighEdu_LF_ImmigrantGrowth, sq_StudentenHO, sq_HoogopgeleideBB, Unemployment_MicroFirms, GDPGrowth_HoogOpBB, Unemployment_bevoldichtheid2006, POPGrowth_Micro, Micro_ImmigrantGrowth, UnemploymentGrowth_HoogOpBB, SUBURB_UNI, Density2006_Micro, Unemployment_StudentHO, POPGrowth_HoogOpBB, Density2006_StudentHO, Gdp_growth_0306, Micro_CORE, HighEdu_LF_SUBURBAN, Micro_SUBURBAN, Unemployment_GDP, Immigrants_growth, HighEdu_LF_UNI, HighEdu_LF_CORE, GDPGrowth_Micro, Density2006_HoogOpBB, Unemploy_growth, StudentHE_LF_SUBURBAN, Density_2006, StudentHE_LF_UNI, POPGrowth_GDP, Micro_Firms_LF, sqSUBURBAN, sqCORE, GDP_capita, StudentHE_LF_Micro, HighEdu_LF, Micro_UNI, UnemploymentGrowth_GDP, GDP_ImmigrantGrowth, GDPGrowth_GDP, GDP_Micro, Density2006_GDP, GDP_UNI, HighEdu_LF_StudentHO, Pop_growth_0306, Unemployment_LF, StudentsHE_LF, GDP_SUBURBAN, GDP_HoogOpBB, GDP_CORE, SQ_UNI

b. Dependent Variable: SQresNLa

Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-6.7176	39.6130	3.4681	4.00743	372
Residual	-10.28822	38.34609	.00000	5.09110	372
Std. Predicted Value	-2.542	9.019	.000	1.000	372
Std. Residual	-1.727	6.437	.000	.855	372

a. Dependent Variable: SQresNLa

3. The Randstad

Regression results & multicollinearity

A: dummy_core/dummy_suburban

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	8.407	2.303		3.650	.000		
	Dummy_core	.266	.644	.037	.413	.681	.567	1.765
	Dummy_suburban	-.496	.651	-.099	-.762	.448	.265	3.775
	HighEdu_LF	-.020	.023	-.108	-.871	.386	.292	3.426
	StudentsHE_LF	.021	.007	.390	2.984	.004	.265	3.780
	Micro_Firms_LF	.040	.005	.652	8.069	.000	.691	1.448
	Dummy_UNI	-1.320	.748	-.262	-1.766	.081	.205	4.876
	Pop_growth_0306	.095	.052	.128	1.835	.070	.935	1.069
	Density_2006	.000	.000	-.107	-1.231	.221	.593	1.687
	Gdp_growth_0306	.045	.108	.040	.421	.675	.499	2.003
	GDP_capita	-.264	.117	-.232	-2.258	.026	.429	2.332
	Unemployment_LF	.490	.111	.395	4.431	.000	.568	1.760
	Unemploy_growth	-.350	.135	-.210	-2.602	.011	.690	1.449
	Immigrants_growth	.052	.052	.075	.997	.321	.795	1.257

a. Dependent Variable: StartupsLF

b. Selecting only cases for which macro_zoning = Randstad

B: dummy_core/dummy_rural

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	7.911	2.584		3.061	.003		
	Dummy_core	.762	.704	.106	1.081	.282	.473	2.114
	Dummy_rural	.496	.651	.100	.762	.448	.262	3.812
	HighEdu_LF	-.020	.023	-.108	-.871	.386	.292	3.426
	StudentsHE_LF	.021	.007	.390	2.984	.004	.265	3.780
	Micro_Firms_LF	.040	.005	.652	8.069	.000	.691	1.448
	Dummy_UNI	-1.320	.748	-.262	-1.766	.081	.205	4.876
	Pop_growth_0306	.095	.052	.128	1.835	.070	.935	1.069
	Density_2006	.000	.000	-.107	-1.231	.221	.593	1.687
	Gdp_growth_0306	.045	.108	.040	.421	.675	.499	2.003
	GDP_capita	-.264	.117	-.232	-2.258	.026	.429	2.332
	Unemployment_LF	.490	.111	.395	4.431	.000	.568	1.760
	Unemploy_growth	-.350	.135	-.210	-2.602	.011	.690	1.449
	Immigrants_growth	.052	.052	.075	.997	.321	.795	1.257

a. Dependent Variable: StartupsLF

b. Selecting only cases for which macro_zoning = Randstad

Autocorrelation & R-square

Model Summary

Model	R: macro_zoning = Randstad (Selected)	R: macro_zoning ~= Randstad (Unselected)	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson Statistic: macro_zoning = Randstad (Selected)	Durbin-Watson Statistic: macro_zoning ~= Randstad (Unselected)
1	.750	.294	.562	.504	1.74496	1.988	1.678

a. Predictors: (Constant), Immigrants_growth, GDP_capita, Pop_growth_0306, StudentsHE_LF, Dummy_core, Unemploy_growth, Micro_Firms_LF, Unemployment_LF, Density_2006, Gdp_growth_0306, Dummy_suburban, HighEdu_LF, Dummy_UNI

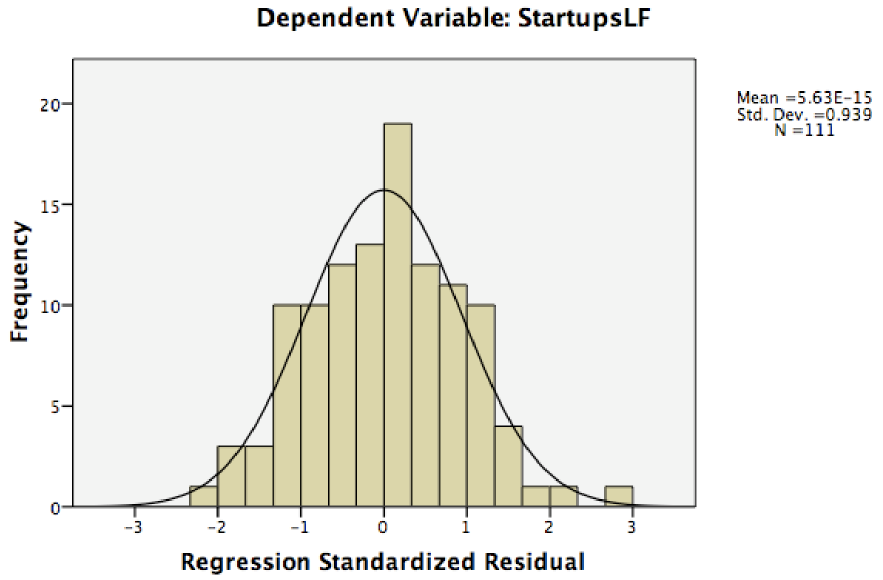
b. Unless noted otherwise, statistics are based only on cases for which macro_zoning = Randstad.

c. Dependent Variable: StartupsLF

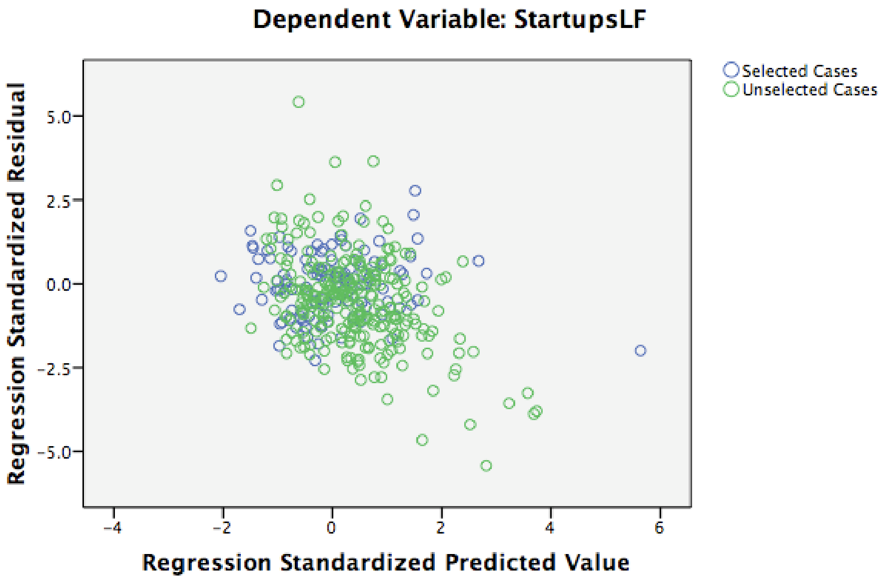
Normality

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Standardized Residual	372	-5.42294	5.42179	-.3799206	1.29468807	.015	.126	1.799	.252
Valid N (listwise)	372								



Heteroskedasticity



Model Summary

Model	R: macro_zoning = Randstad (Selected)	R: macro_zoning ~= Randstad (Unselected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	.960	.	.921	.568	2.42185

a. Predictors: (Constant), UNI_ImmigrantGrowth, Density2006_GDP, POPGrowth_StudentHO, Unemployment_GDPGrowth, StudentHE_LF_SUBURBAN, UnemploymentGrowth_GDPGrowth, CORE_ImmigrantGrowth, sq_unemploy_growth, UnemploymentGrowth_POPGrowth, sq_Micro_BB, POPGrowth_Core, CORE_UNI, GDPGrowth_Core, GDP_capita, GDPGrowth_ImmigrantGrowth, UnemploymentGrowth_UNI, UnemploymentGrowth_CORE, POPGrowth_ImmigrantGrowth, Density2006_ImmigrantGrowth, SQ_POPgrowth, sqUnemploy, UnemploymentGrowth_Density2006, HighEdu_LF, SQ_IMMIGRANT_Growth, GDPGrowth_UNI, Density2006_SUBURBAN, POPGrowth_Bevoldichtheid, GDPGrowth_Suburban, Density2006_GdpGrowth, SQ_GDPGrowth, Density2006_CORE, POPGrowth_GDPGrowth, Density2006_UNI, Unemployment_ImmigrantGrowth, sq_StudentenHO, POPGrowth_Suburban, UnemploymentGrowth_Micro, UnemploymentGrowth_ImmigrantGrowth, Unemployment_SUBURBAN, GDPGrowth_StudentHO, UnemploymentGrowth_StudentHO, Micro_Firms_LF, UnemploymentGrowth_SURURBAN, StudentHE_LF_ImmigrantGrowth, Unemployment_POPGrowth, sqBevoldichtheid2006, POPGrowth_UNI, Micro_UNI, Unemployment_CORE, Immigrants_growth, UnemploymentGrowth_HoogOpBB, Unemployment_GDP, sq_HoogopgeleideBB, Unemployment_unemployGrowth, Unemployment_bevoldichtheid2006, HighEdu_LF_ImmigrantGrowth, POPGrowth_GDP, GDPGrowth_HoogOpBB, Micro_CORE, SUBURB_ImmigrantGrowth, Micro_ImmigrantGrowth, Unemployment_UNI, Density2006_StudentHO, Gdp_growth_0306, Density2006_Micro, Unemployment_HoogopBB, Micro_SUBURBAN, Density2006_HoogOpBB, StudentHE_LF_Micro, Unemployment_MicroFirms, Unemployment_StudentHO, GDP_CORE, POPGrowth_HoogOpBB, Unemploy_growth, HighEdu_LF_SUBURBAN, HighEdu_LF_Micro, SUBURB_UNI, HighEdu_LF_UNI, GDP_SUBURBAN, HighEdu_LF_CORE, GDP_ImmigrantGrowth, GDPGrowth_Micro, UnemploymentGrowth_GDP, POPGrowth_Micro, StudentHE_LF_CORE, Density_2006, Unemployment_LF, StudentsHE_LF, GDPGrowth_GDP, StudentHE_LF_UNI

b. Unless noted otherwise, statistics are based only on cases for which macro_zoning = Randstad.

c. Dependent Variable: SQresRANDa

Residuals Statistics

	macro_zoning = Randstad (Selected)					macro_zoning ~= Randstad (Unselected)				
	Minimum	Maximum	Mean	Std. Deviation	N	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-1.2680	23.4607	2.6609	3.53533	111	-30.2376	63.7854	3.6594	10.85127	261
Residual	-2.88039	3.76288	.00000	1.03268	111	-56.55352	94.33321	3.09039	16.77108	261
Std. Predicted Value	-1.111	5.883	.000	1.000	111	-9.306	17.290	.282	3.069	261
Std. Residual	-1.189	1.554	.000	.426	111	-23.351	38.951	1.276	6.925	261

a. Dependent Variable: SQresRANDa

b. Pooled Cases

4. The intermediate zone & periphery

Regression results & multicollinearity

A: dummy_core/dummy_suburban

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	3.633	2.192		1.658	.099		
	Dummy_core	.815	.471	.106	1.733	.084	.638	1.568
	Dummy_suburban	.595	.338	.120	1.763	.079	.516	1.939
	HighEdu_LF	.006	.017	.025	.319	.750	.384	2.601
	StudentsHE_LF	-.004	.003	-.124	-1.344	.180	.278	3.592
	Micro_Firms_LF	.064	.005	.658	11.960	.000	.784	1.275
	Dummy_UNI	1.074	.510	.173	2.105	.036	.353	2.831
	Pop_growth_0306	.101	.069	.076	1.476	.141	.901	1.109
	Density_2006	.001	.000	.127	2.125	.035	.669	1.496
	Gdp_growth_0306	-.063	.067	-.054	-.948	.344	.736	1.358
	GDP_capita	-.105	.109	-.061	-.962	.337	.590	1.695
	Unemployment_LF	.081	.063	.079	1.298	.195	.648	1.543
	Unemploy_growth	.029	.086	.018	.331	.741	.844	1.185
	Immigrants_growth	-.048	.044	-.055	-1.095	.274	.954	1.048

a. Dependent Variable: StartupsLF

b. Selecting only cases for which macro_zoning > Randstad

B: dummy_core/dummy_rural

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	4.228	2.252		1.878	.062		
	Dummy_core	.220	.493	.029	.447	.656	.582	1.719
	Dummy_rural	-.595	.338	-.127	-1.763	.079	.458	2.183
	HighEdu_LF	.006	.017	.025	.319	.750	.384	2.601
	StudentsHE_LF	-.004	.003	-.124	-1.344	.180	.278	3.592
	Micro_Firms_LF	.064	.005	.658	11.960	.000	.784	1.275
	Dummy_UNI	1.074	.510	.173	2.105	.036	.353	2.831
	Pop_growth_0306	.101	.069	.076	1.476	.141	.901	1.109
	Density_2006	.001	.000	.127	2.125	.035	.669	1.496
	Gdp_growth_0306	-.063	.067	-.054	-.948	.344	.736	1.358
	GDP_capita	-.105	.109	-.061	-.962	.337	.590	1.695
	Unemployment_LF	.081	.063	.079	1.298	.195	.648	1.543
	Unemploy_growth	.029	.086	.018	.331	.741	.844	1.185
	Immigrants_growth	-.048	.044	-.055	-1.095	.274	.954	1.048

a. Dependent Variable: StartupsLF

b. Selecting only cases for which macro_zoning > Randstad

Autocorrelation & R-square

Model Summary

Model	R macro_zoning > Randstad (Selected)	R macro_zoning <= Randstad (Unselected)	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson Statistic macro_zoning > Randstad (Selected)	Durbin-Watson Statistic macro_zoning <= Randstad (Unselected)
1	.643	.560	.413	.382	1.81822	2.081	1.540

a. Predictors: (Constant), Immigrants_growth, Dummy_core, Dummy_UNI, Unemploy_growth, Micro_Firms_LF, Pop_growth_0306, GDP_capita, Gdp_growth_0306, Density_2006, Unemployment_LF, Dummy_suburban, HighEdu_LF, StudentsHE_LF

b. Unless noted otherwise, statistics are based only on cases for which macro_zoning > Randstad.

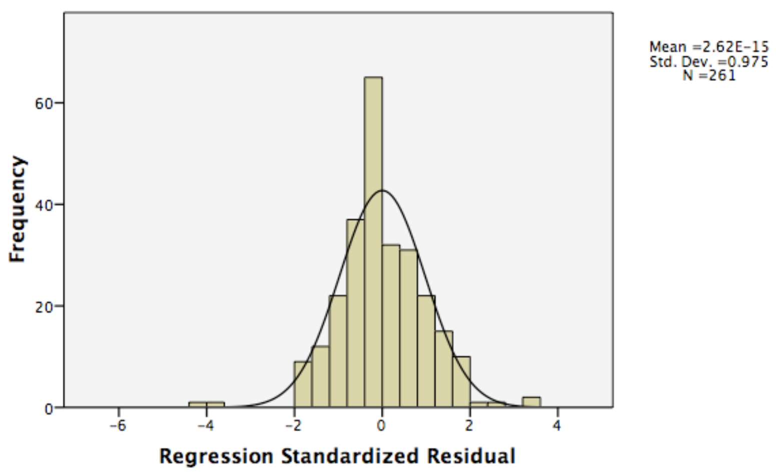
c. Dependent Variable: StartupsLF

Normality

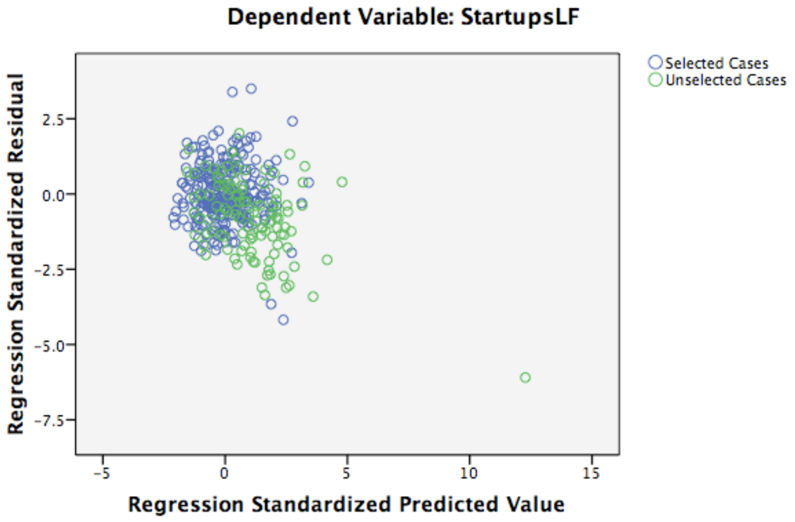
Descriptive Statistics

	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness Statistic	Skewness Std. Error	Kurtosis Statistic	Kurtosis Std. Error
Standardized Residual	372	-6.09464	3.49823	-.2410635	1.13518218	-.540	.126	2.305	.252
Valid N (listwise)	372								

Dependent Variable: StartupsLF



Heteroskedasticity



Model Summary

Model	R macro_ zoning > Randstad (Selected)	R macro_ zoning <= Randstad (Unselected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	.641	.	.411	.042	6.08997

a. Predictors: (Constant), UNI_ImmigrantGrowth, Micro_UNI, Gdp_growth_0306, SQ_POPgrowth, POPGrowth_UNI, UnemploymentGrowth_Micro, CORE_ImmigrantGrowth, Density2006_GdpGrowth, UnemploymentGrowth_ImmigrantGrowth, Micro_Firms_LF, POPGrowth_ImmigrantGrowth, GDP_capita, SQ_IMMIGRANT_Growth, GDPGrowth_Core, Density2006_SUBURBAN, Unemployment_GDP, GDPGrowth_ImmigrantGrowth, CORE_UNI, UnemploymentGrowth_UNI, HighEdu_LF_Micro, UnemploymentGrowth_POPGrowth, sq_unemploy_growth, POPGrowth_Suburban, UnemploymentGrowth_CORE, POPGrowth_GDPGrowth, Density2006_ImmigrantGrowth, sq_StudentenHO, GDPGrowth_Suburban, SUBURB_ImmigrantGrowth, POPGrowth_Core, sqBevoldichtheid2006, UnemploymentGrowth_SURURBAN, POPGrowth_Bevoldichtheid, UnemploymentGrowth_Density2006, Unemployment_SUBURBAN, Unemployment_ImmigrantGrowth, StudentHE_LF_CORE, Unemployment_POPGrowth, Density2006_CORE, UnemploymentGrowth_GDPGrowth, POPGrowth_StudentHO, Density2006_UNI, GDPGrowth_StudentHO, Unemployment_unemployGrowth, HighEdu_LF_ImmigrantGrowth, UnemploymentGrowth_StudentHO, Unemployment_StudentHO, SQ_GDPGrowth, Unemployment_GDPGrowth, sq_HoogopgeleideBB, POPGrowth_Micro, UnemploymentGrowth_HoogOpBB, Micro_ImmigrantGrowth, GDPGrowth_UNI, Unemployment_HoogopBB, Density2006_Micro, GDPGrowth_HoogOpBB, StudentHE_LF_ImmigrantGrowth, Micro_CORE, POPGrowth_HoogOpBB, Unemployment_UNI, sqUnemploy, Micro_SUBURBAN, Unemployment_bevoldichtheid2006, Unemployment_MicroFirms, Unemployment_CORE, StudentHE_LF_SUBURBAN, Density2006_HoogOpBB, GDP_StudentHO, HighEdu_LF_CORE, GDPGrowth_Micro, Density2006_StudentHO, HighEdu_LF_SUBURBAN, Immigrants_growth, StudentHE_LF_UNI, Unemploy_growth, sq_Micro_BB, POPGrowth_GDP, HighEdu_LF_UNI, sqSUBURBAN, Density2006_GDP, SUBURB_UNI, sqCORE, GDP_HoogOpBB, StudentHE_LF_Micro, UnemploymentGrowth_GDP, GDP_ImmigrantGrowth, GDP_Micro, GDP_UNI, Pop_growth_0306, GDP_SUBURBAN, Unemployment_LF, GDPGrowth_GDP, HighEdu_LF, SQ_UNI, HighEdu_LF_StudentHO, sq_GDP, Density_2006, GDP_CORE, StudentsHE_LF

b. Unless noted otherwise, statistics are based only on cases for which macro_zoning > Randstad.

c. Dependent Variable: SQresRESTa

Residuals Statistics

	macro_zoning > Randstad (Selected)					macro_zoning <= Randstad (Unselected)				
	Minimum	Maximum	Mean	Std. Deviation	N	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-5.0336	35.4651	3.1286	3.98805	261	-30.2228	32.3654	.7017	9.30771	111
Residual	-11.04642	37.30665	.00000	4.77737	261	-29.63733	144.87216	6.82459	17.76551	111
Std. Predicted Value	-2.047	8.108	.000	1.000	261	-8.363	7.331	-.609	2.334	111
Std. Residual	-1.814	6.126	.000	.784	261	-4.867	23.789	1.121	2.917	111

a. Dependent Variable: SQresRESTa

b. Pooled Cases