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Population change and new firm formation in urban and rural regions

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Abstract

Many regions across the EU, including the Netherlands, face the challenge of population decline, which entails changing demographics and related social and economic implications. This paper looks into the connection between population change, and population decline in particular, and the rates of new firm formation. Although it is clear that fewer people will eventually lead to fewer (new) firms, we assess whether this negative relationship differs with different rates of population change and across regional contexts. Population decline occurs in different types of regional context, which could also lead to different outcomes. In this study we distinguish between urban and rural areas.

In order to establish the impact of population change, and population decline in particular, on entrepreneurship, this paper examines data on population density, size, growth and decline, together with firm dynamics for the period 2003-2009, retrieved from the LISA database. In general, the results show that the relationship between entrepreneurship and population change depends heavily on the regional context. When assessing different levels of population change, we find that its relationship with entrepreneurship depends strongly on the regional context. The results indicate that urban regions tend to experience strong negative impacts as a result of population change, while the impact on rural regions remains positive. In conclusion, we find clear differences in the intensity of the impact of population change on new firm formation according to the type of region. The regional context and the intensity of decline must be taken into account when determining the kind of coping mechanism needed to deal with the consequences of decline.

Key words: population decline, new firm formation, urban and rural regions

JEL codes: M13, R11, O18

Introduction

Regional decline in population and associated decline in employment and amenities is expected to occur increasingly in developed countries (Fésüs et al., 2008; Polèse and Shearmur, 2006; Van Wissen, 2010). Population decline is a complex issue with many social and economic implications; with mainly young people leaving, fewer children are born and the ageing population is left with fewer employment

opportunities, and fewer retail and care facilities (Haartsen and Venhorst, 2010; Van Wissen, 2010). Social expenditure is put under strain because of a shrinking labour force and decreasing tax revenue, a direct consequence of young people migrating out. This process makes it difficult for small communities to maintain adequate infrastructure, educational and medical facilities and other public services, which in turn can make it difficult to attract new immigrants or prevent current residents from relocating (Fésüs et al., 2008; Haartsen and Venhorst, 2010; Mai and Bucher, 2005; Polèse and Shearmur, 2006; Simmie and Martin, 2010), thereby creating a negative spiral. Furthermore, social ties are disrupted by continuous out-migration, causing a decrease in support systems and social capital, which can have detrimental effects on liveability. Population decline can thus, depending on the intensity, constitute a deeply rooted problem. Our intent is not to counteract population decline, but by focussing on the consequences of population decline this study aims to contribute to addressing the associated problems. We thereby follow Van Wissen (2010) who argues that "*it is pointless to combat population decline, but dealing with its consequences is worthwhile"*.

The number of studies addressing population decline and its consequences has increased substantially in the past decade. Though research on depopulation is far from novel – already in 1890, Arsene Dumont addressed the issue of the declining population in France – the effects of population decline are still unclear (SER, 2011). Entrepreneurship can play an important part in maintaining the quality of life in declining regions. The economic impact of entrepreneurship has been firmly established (see, for example, Acs and Armington, 2004; Stam, 2009). It drives competition and innovation, and consequently GDP and employment growth. Entrepreneurship can also contribute to other aspects of quality of life, such as the level of social capital, in that it creates trust, maintains social relations and offers meeting places (Morris and Lewis, 1991; Westlund, 2003). However, private businesses, including grocery stores, restaurants and other commercial establishments, are less likely to operate in declining regions. They are more spread out and more likely to be smaller in areas that have a relatively small number of residents, as they require a minimum number of customers to remain viable (McGranahan and Beale, 2002). It is clear that fewer people (less demand) leads to fewer new firms (reduced supply), we examine whether this inherently negative relationship varies with the rate of population change and across regional contexts. Traditionally, entrepreneurship has been seen as a mechanism of economic growth. Research regarding the characteristics of entrepreneurship in a context of economic stagnation seems lacking, however, and we aim to contribute to this topic with this paper.

New firm formation in this study is defined as the number of newly founded firms per 1000 labour market population in a particular region. This study focusses on two aspects of the regional context that are

expected to impact start-up rates. The first aspect is the actual change in population. A growing population is positively related to new firm formation in a country or region (Armington and Acs, 2002; Audretsch and Fritsch, 1994; Bosma et al., 2008; Verheul et al., 2001). The positive effects of growth will be lacking in declining regions, possibly leading to an additional loss of (small) businesses and fewer start-ups. On the other hand, despite declining population/circumstances, it is envisaged that a minimum number of firms are needed in a region to fulfil demand, positively influencing the start-up rate and thus smoothing the negative trend. As the aim of this study is to determine the relationship between (especially negative) population change and new firm formation, population growth must also be incorporated, since consideration of diminishing regions entails an implicit comparison with growing regions. Therefore, we use the term 'population change' from this point onwards. The first research question is about the impact of population change on the level of entrepreneurship. More specifically, how does this impact change depending on the intensity of population decline or growth? The second research question is concerned with the context in which population change takes place. Population decline occurs in different regional settings, possibly leading to different outcomes; urban areas offer important advantages to entrepreneurs such as a closer proximity to the consumer market, but the periphery could attract cottage industry with, for example, Internet-based service firms based in the home location. We therefore distinguish between urban and rural areas. The second research question is the following: Is the relationship between new firm formation and population change mediated by the urban or rural regional contexts?

We first elaborate on the impact of population decline on entrepreneurship, and then describe the data and methodology used. Next the key findings are presented and discussed. The final section presents our conclusions.

Population change and new firm formation

A well-recognized way to assess regional distribution of start-up rates is the eclectic framework employed by Verheul and others (2001), which explains and integrates the supply side of entrepreneurship, the demand side and the institutional environment (Verheul et al., 2001; Wennekers et al., 2005). Demand-side variables represent entrepreneurial opportunities, while supply-side variables represent the resources and abilities of individuals and their attitudes towards entrepreneurship including demographics, wage rates and employment status (Bosma et al., 2008; Verheul et al., 2001; Wennekers et al., 2005). The institutional environment influences the supply side of entrepreneurship and shapes the context within which supply and demand assessments are made. The institutional context is often related to culture (Wennekers, 2010). Examples of institutional issues are the fiscal environment, labour market regulations

and intellectual property rights (Wennekers, 2010) as well as 'background' institutions such as trust and the education system (Verheul et al., 2001). Population dynamics can affect each of these dimensions.

Population change

Population change can influence new firm formation by providing opportunities for new economic activity as new and bigger consumer markets emerge because of the growing population (Armington and Acs, 2002; Wennekers et al., 2005). Goods and services sought by individuals, in particular, should create new prospects for new firms and lead to start-up activity (Reynolds et al., 1995). Population growth may also be a push factor to engage in new economic activity in order to make a living: the expanding population places additional strain on salaries and thereby lowers the opportunity costs for self-employment (Verheul et al., 2001). Several studies, indeed, have found that population growth is positively related to start-up rates (see, for example, Armington and Acs, 2002; Bosma et al., 2008; Reynolds et al., 1995; Wennekers et al., 2005), although other studies have not found a significant effect (Audretsch and Fritsch, 1994; Garofoli, 1994). As population growth reflects an increase in both demand and supply for start-ups, it is expected that its effect on the rate of new firm formation will be positive.

However population change occurs in two directions – growth and decline – and differs in intensity. Building on the theory of branching and self-feeding growth hypothesized by Frenken and Boschma (2007), population change could potentially have an additional effect on new firm formation when the change is more intense. According to this evolutionary perspective, growth is self-feeding. Frenken and Boschma argue that the probability of innovation increases with the variety available for recombination. The idea of endogenous growth also holds for cities: the more variety already present, the higher the probability that new varieties can be created through recombining old routines. In other words, the creation of opportunities is self-reinforcing: more people mean more possible combinations and more opportunities. It also implies that more *newcomers* mean more *re*combinations. This results in an exponential relationship between population and opportunities by recombination, reflected in new firm formation. Frenken and Boschma (2007) also indicate that the relation is not endlessly exponential: it will reach a 'ceiling' after which there is no more room for improvement.

Population decline may also have a self-reinforcing effect. Start-up risk will be higher in a declining region given the uncertainties that accompany decline. Therefore, population decline is likely to have an adverse impact on the level of new firm formation by increasing the risk of starting up a new business. In addition, the likely reduction in support systems caused by out-migration might also have an impact. Starting a new firm is a highly social process, as information, new ideas and resources are predominantly

acquired via personal networks (Aldrich et al., 1998; Davidsson and Honig, 2003). Population decline affects the level of support – financial, emotional and other kinds of support (Fésüs et al., 2008). On the other hand, decline can lead to restructuring, and also cause declining regions to experience more self-employment due to necessity-driven entrepreneurship.

Urban and rural regions[1]

The impact of population change depends on the specific regional context. Urban regions are often characterized by a more diversified population, leading to more variety in demand. Higher diversity also stimulates new firm start-ups; more diversified cities have a higher chance of fostering innovation than less diversified cities (Bosma et al., 2008; Frenken and Boschma, 2007). Conditions for entering a market are thought to be more favourable in more densely populated regions (Audretsch and Fritsch, 1994; Sternberg, 2011), as the consumer market is in closer proximity and the more developed business infrastructure (Bruderl and Preisendorfer, 1998; Fritsch and Mueller, 2008). In addition, agglomeration effects can positively affect new firm formation through increased local market opportunities relating to the consumer market and necessary inputs (Reynolds et al., 1995). Urbanization also improves the likelihood of the presence of a more skilled workforce and enables ideas and knowledge to flow faster. Moreover, the risk of starting a business in urban areas is considered relatively low due to the rich employment opportunities which function as a safety net in case the new firm fails (Stam, 2009). Empirical results appear to confirm the importance of urbanization for entrepreneurship (Sternberg, 2011).

These differences will most likely lead to different impacts as a result of population decline. Urbanization could have a mediating effect, causing urban areas to experience less severe consequences of population decline (Haartsen and Venhorst, 2010). Several studies show that agglomeration, controlled for other determinants, has a positive impact on the rate of new firm formation (Armington and Acs, 2002; Audretsch and Fritsch, 1994; Bosma et al., 2008). Urban areas – given their larger existing stock of both people and firms – can potentially generate many new recombinations with every new connection, until they reach their ceiling and the effect stabilizes.

The influence of urbanization on new firm formation is, however, not univocally agreed upon. A higher degree of urbanization can lead to the pursuit of economies of scale, which enables firms to serve their

[1] The Netherlands is a special case within the European Union with regard to urban and rural regions. For the definition used for urban and rural regions, please refer to the data and methodology section.

clients more efficiently and leaves fewer opportunities for small firms (Verheul et al., 2001). Other negative effects of agglomeration include excessive competition, possibly resulting in increased wages and elevated input prices, thus discouraging entry (Nyström, 2007; van Stel and Suddle, 2008). Van Stel and Suddle (2008) found a negative effect for start-ups in the Netherlands shown by the number of service start-ups, as they are less dependent on the agglomeration benefits mentioned.

Regions will continue to need a minimum supply of facilities in retail trade, repair and personal services (Wennekers, 2006), regardless of their size and population decline or growth. This would imply that there is a lower limit of supply and demand. Another potential mediating effect, especially in green and attractive rural regions, is a region's ability to attract nascent entrepreneurs that are looking to start up a business from home. Such cottage industry does not depend on a close physical proximity to the market as it is mainly internet based. All of these considerations – the Dutch context of urban areas in competition with neighbouring intermediately urban areas, and the possible denominator effects for rural regions - lead to an expectation that population change will affect urban and rural regions differently.

Data, methodology and empirical strategy

To determine the spatial distribution of new firm formation in the context of population change, this study examined data on population density, size, growth and decline, retrieved from Statistics Netherlands (CBS). To assess the current and past state of entrepreneurial activities and firm dynamics, we used the LISA database. To avoid effects of coincidental occurrences in a certain year, data was used from 2003 to 2009. The LISA database provides information at the level of the firm for each year, thereby uncovering start-ups, firm closures, sector changes and the total number of jobs for all establishments in the Netherlands with paid employees. The start-up data only includes genuinely new firms, excluding relocations. Every establishment is traceable through time and space by a unique identification number. The dataset consists of over 6.4 million cases between 2003 and 2009, which were aggregated by municipality for the analyses. A total of 8900 cases were excluded from our analyses, as these firms showed a total of zero jobs in a particular year. The data is truncated and so information on new start-ups in 2003 is unavailable. The analyses were performed on all municipalities, which were aggregated to match the number of municipalities in 2009 (441) and to facilitate comparisons between several years. As a consequence of using a relative low aggregation level, there is a probability that the municipalities are spatially dependent. We therefore corrected for spatial autocorrelation.

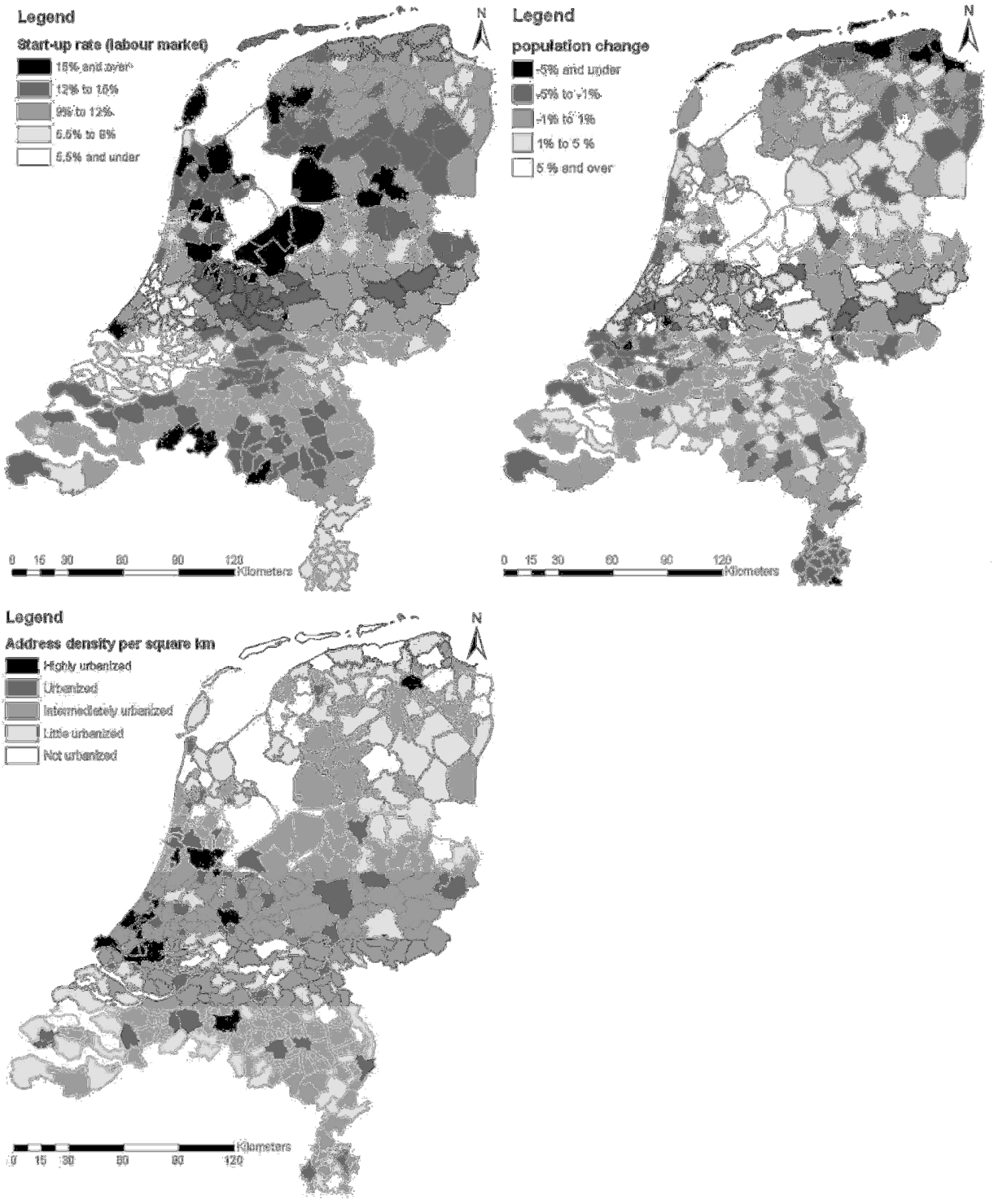

Figure 1. Top left: average start-up rate 2004-2009. Top right: population change 2003-2009. Bottom left: degree of urbanization in 2009.

The rate of new firm formation was calculated using the labour market approach, as shown in Figure 1 (top left). There are two basic methods for comparing entry activity across markets. The first is known as the ecological approach, as it standardizes the number of new firms relative to the stock firms in the given market at the beginning of the period (Audretsch and Fritsch, 1994; Koster, 2006). This study employed the second method, the labour market approach, which uses the potential workforce in the region as the denominator for standardizing the number of entrants. This method was preferred as it is based on the theory of entrepreneurial choice. That is, each new firm is started by an individual person (Audretsch and Fritsch, 1994). An important implicit assumption made by the labour market approach is that the entrepreneur is in the same labour market within which that new firm operates. Considering the fact that most new firms are initially established at home or in close proximity to it (Stam, 2009), and that most new entrepreneurs will have some work experience in the region, the implications of this assumption were acceptable, as we also corrected for this empirically by using spatial regressions.

Identifying declining regions

Although the overall Dutch population is not expected to decrease until 2040 (Haartsen and Venhorst, 2010), rural and peripheral regions such as the northeast of Groningen, Zeeuwsch-Vlaanderen and de Achterhoek are already undergoing population decline. The only urbanized region which is already confronted with decline is the south of Limburg. The current state of population change is visualized in Figure 1 (top right). In total, 110 municipalities have seen more than 1% decline, of these declining regions only 10 experienced more than 5% decline.

Urban and rural regions

The OECD methodology defines rural areas as those having a population density below 150 inhabitants per square kilometre (OECD, 2008). If the standard OECD methodology is applied to define rural areas, it would appear that there are no predominantly rural areas in the Netherlands. However, according to the perception of the Dutch population, the Northern part of the country is a typically rural area (Haartsen, 2002). Therefore we adopted a method frequently used in Dutch policies which is based on surrounding address density, either at postal code area or municipality level. This measure uses the average number of addresses per square kilometre within a radius of one kilometre. Address density uses the concentration of human activities such as living, working and utilizing amenities as indicators of urbanization – the lower the concentration of these activities, the lower the level of urbanization (Haartsen, 2002). Rural areas are then defined as the areas with less than 500 addresses per square kilometre. In line with the general perception of the Dutch population, the three northern provinces of Friesland, Drenthe and Groningen are the most rural, together with Zeeland (see Figure 1, bottom right).

Control variables

In addition to the changes in population size and regional contexts, many other economic, technological, demographic, cultural and institutional variables determine the level of entrepreneurship. This study groups these variables into three broad categories: demand factors, supply factors and institutions (Bosma et al., 2008; Verheul et al., 2001). Supply and demand factors have already been mentioned and these will be discussed simultaneously.

Population change lies at the root of societal change, making *age distribution* an important determinant for the level of entrepreneurship that needs to be controlled for. People of a certain age are considered more likely to start a business. Several publications show that the probability of a person starting his/her own business increases with age. People typically start a business between the ages of 25 and 40 years. New entrepreneurs in the Netherlands are usually between 25 and 34 years of age (Verheul et al., 2001; Wennekers, 2005). At the same time, 45 years is the average age of those who are self-employed (in Dutch: ZZP-er), a group that has been growing rapidly in the last decade. They often continue their business beyond the age of 65 (Kösters, 2009). Thus, we expect aging to have a positive relation to the rate of new firm formation. Next, the *share of young people* is an indicator of the presence of young families. Although research regarding family dynamics is quite rare (Aldrich and Cliff, 2003), one can argue that potential entrepreneurs with young families might be more reluctant to take on the risk of starting a new firm, influencing start-up rates negatively. Also, a growing proportion of children live in single-parent families (Aldrich and Cliff, 2003), for whom the perceived risks will be even greater. Therefore, it can be argued that an increase in young people will have an adverse effect on the start-up rates in the same region. Another societal trend is the decreasing average *household size*. A larger household size is normally positively related to new firm formation (Ritsila and Tervo, 2002). On the supply side, the *level of education* is positively associated with entry rates. Highly skilled labour and the proportion of college graduates are found to be positively related to start-up rates (Armington and Acs, 2002; Audretsch and Fritsch, 1994).

The effect of *immigration* is mainly found on the supply side, influenced by the type of person that immigrates. Immigrants are on average less risk-averse; moving to another country or region has a certain risk involved, as does starting a business (Wennekers, 2005). Immigration can, however, also have an indirect effect via population growth, creating more demand (Verheul et al., 2001). However, we assessed the impact of the total immigration, not the net amount. Immigration is therefore interpreted as a supply factor, with an expected positive relation to start-up rates. The fifth control factor is *income*. Income can be seen as both a demand and supply factor. Income growth increases demand but also facilitates access

to capital for aspirant entrepreneurs. Verheul et al. (2001) discussed conflicting hypotheses explaining the impact of one particular form of income, wages, on start-up rates. The first hypothesis argues that high wages lead to high opportunity costs of being self-employed, and therefore relate to a lower level of new firm formation. The second hypothesis argues that high wages are positively correlated to start-up rates, as higher income is a sign of a prosperous economy with above average survival rates. In addition, Bosma et al. (2008) mention the potential negative influence on self-employment due to the high costs of hiring employees. *Unemployment rates* generate similar hypotheses as described for wages. High unemployment rates may serve as a push factor, causing necessity-driven entrepreneurship, thus increasing start-ups. On the other hand, high unemployment rates can indicate a lack of entrepreneurial opportunity, thus associating with low new firm formation (Audretsch and Thurik, 2000; Verheul et al., 2001).

Other control variables influencing demand in a region, and thereby the rate of new firm formation, are technologies, consumer demand and the industrial structure of the economy (Verheul et al., 2001). These factors influence the *sectorial structure* and the diversity in market demand leading to opportunities for entrepreneurship. Variety in a region's sector structure represents more opportunities for new firm formation (Bosma et al., 2008). A high degree of services in a certain municipality may also positively affect entry rates because of lower average start-up costs (e.g. M. Fritsch, 1997). Bosma et al. (2008) also include the size of the local industry as a demand factor, since greater competition can contribute to new start-ups. The *Herfindahl index* for 2003 was used to measure the degree of concentration in the market, as an indicator for competition.

Finally, the institutional context of the region influences new firm formation. The institutional environment influences the supply side of entrepreneurship and is often related to culture (Wennekers, 2010). Given that this study focuses on the Netherlands only, many institutional aspects such as property rights and bankruptcy laws are the same for all regions because they are set at the national level. We focused therefore on so-called background institutions: the entrepreneurship culture of the region and level of social capital. As a proxy for an entrepreneurial culture, the share of the *public sector* in the region is used. A Swedish study found that a large government sector has a negative impact on new firm formation (Nyström, 2008). The size of the public sector is therefore hypothesized to have a negative impact on the dependent variable. The level of social capital is measured via the proxy *voter turnout* for the elections for the Lower House (Tweede Kamer in Dutch) in 2006. Voter turnout is a simple measure, but is associated with the level of social capital and reflects participation and involvement (Cox, 2003; Guiso et al., 2004).

New firm formation – dependent variable		**Mean (SD)**
Start-ups rates, labour market approach. Mean over 2004-2009, LISA dataset		10.43 (3.32)
Explanatory variables		
POP_CHANGE: Changes in population size between 2003-2009, from Statistics Netherlands on municipality level. For analysis, five categories are used: strong growth (>5%), growth (> 1 to 5% growth), stable (-1%><1%, decline (1 to 5% decline) and strong decline (>5% decline). Stable regions are used as a reference category.	*STRONG DECLINE* *DECLINE* *STABLE* *GROWTH* *STRONG GROWTH*	0,02 (0.15) 0.23 (0.42) 0.33 (0.47) 0.32 (0.47) 0.09 (0.29)
URBANIZATION: Population density – based on address density per square kilometre, from Statistics Netherlands at municipality and neighbourhood levels. For analysis, three categories are used: urban, intermediately urban and rural. Urban denotes municipalities with address density >1500 and rural denotes municipalities with an address density of <500. Intermediately urban regions are used as the reference category.	*RURAL* *INTERMEDIATE* *URBAN*	0.29 (0.45) 0.53 (0.49) 0.17 (0.38)
Control variables		
Age distribution – measured by changes in age structure per municipality between 2003 and 2009, in the categories "*UNDER_15"*, and *"OVER_65"*. The potential workforce is left out of analyses due to multicollinearity. Data from Statistics Netherlands.	*UNDER_15* *OVER_65*	-1.07 (0.74) 1.99 (0.95)
HOUSE_SIZE: Household size – measured by changes in average household size between 2003 and 2009. Data from Statistics Netherlands.		-0.08 (0.03)
HIGH_EDU: share of higher educated inhabitants relative to the active workforce, mean over 2000-2007 due to data availability. 61 small municipalities were excluded from the source dataset for privacy reasons. These municipalities are estimated based on the share of higher educated in the COROP region. Data from the EBB (Enquete Beroepsbevolking) executed by Statistics Netherlands.		22.93 (7.10)
IMMIGRANTS: Average number of internal migrants between 2003 and 2009 per inhabitant per municipality. Statistics Netherlands, municipality level.		3.73 (1.06)
INCOME: The development in average income between 2003 and 2007. Due to changes in the definitions used by Statistics Netherlands, 2008 and 2009 are excluded from analysis.		0.05 (0.02)
UNEMPL: Unemployment rates – over the years 2003-2008, data from Statistics Netherlands, computations by A. Edzes.		5.03 (1.75)
HERF_INDEX: the sum of the squares of the market share of firms in all municipalities in 2003. Measured by firm size in number of jobs, based on the		0.02 (0.03)

LISA dataset.	
SERVICE_SEC: Share of the service sector per municipality, measured in share of jobs per municipality, based on the LISA dataset.	63.62 (9.32)
PUBLIC_SEC: Share public sector – The share of the public sector (sbi 2 digit: 84, 85, 91), measured in share of jobs per municipality, based on the LISA dataset.	10.42 (4.91)
VOTING: Voter turnout – the voter turnout for the elections for the Lower House (Tweede Kamer) in 2006. Data from Statistics Netherlands.	82.81 (3.81)

Table 1. Overview of variables including data sources

Results

First, descriptive results regarding the link between population change and the rate of new firm formation, in different regional contexts, are presented. Second, multiple regression models are shown which focus on explaining the rate of new firm formation by the intensity of population change and the degree of urbanization.

Population descriptives

Three small steps were taken towards answering the first research question. Starting with the relationship between population and the number of start-ups; we expect a positive relationship, between the absolute number of new establishments and the absolute number of inhabitants in the same municipality. On first glance the general picture portrayed by the scatterplot diagram in the top left quadrant of Figure 2 appears to be approximately linear, with a larger population resulting in more firm start-ups. Consequently, the relationship between the population size and the start-up rate, as depicted in the lower left quadrant of Figure 2, does not appear from the scatterplot to vary systematically with the size of the local economy. Here, the perforated reference lines show the average population size and average start-up rates for each municipality, and as we see in lower left quadrant of Figure 2, the start-up rates do not appear to diverge systematically from the average rate according to the size of the local economy. What does appear to be the case, however, is that the dispersion of start-up rates is much higher for small population and more sparsely populated municipalities than for larger municipalities. Looking at the lower right hand side quadrant diagram of Figure 2 we see from the scatterplot that that there is no clear and systematic relationship between start-up rates and population growth[2].

[2] The number of municipalities in each category which is above or below the national average in terms of start-up rates and population size, or population change, are denoted in each of the four quadrants I, II, III, and IV in the two lower quadrant diagrams in Figure 2. On this basis, relatively more (180/150) smaller regions appear to out-perform

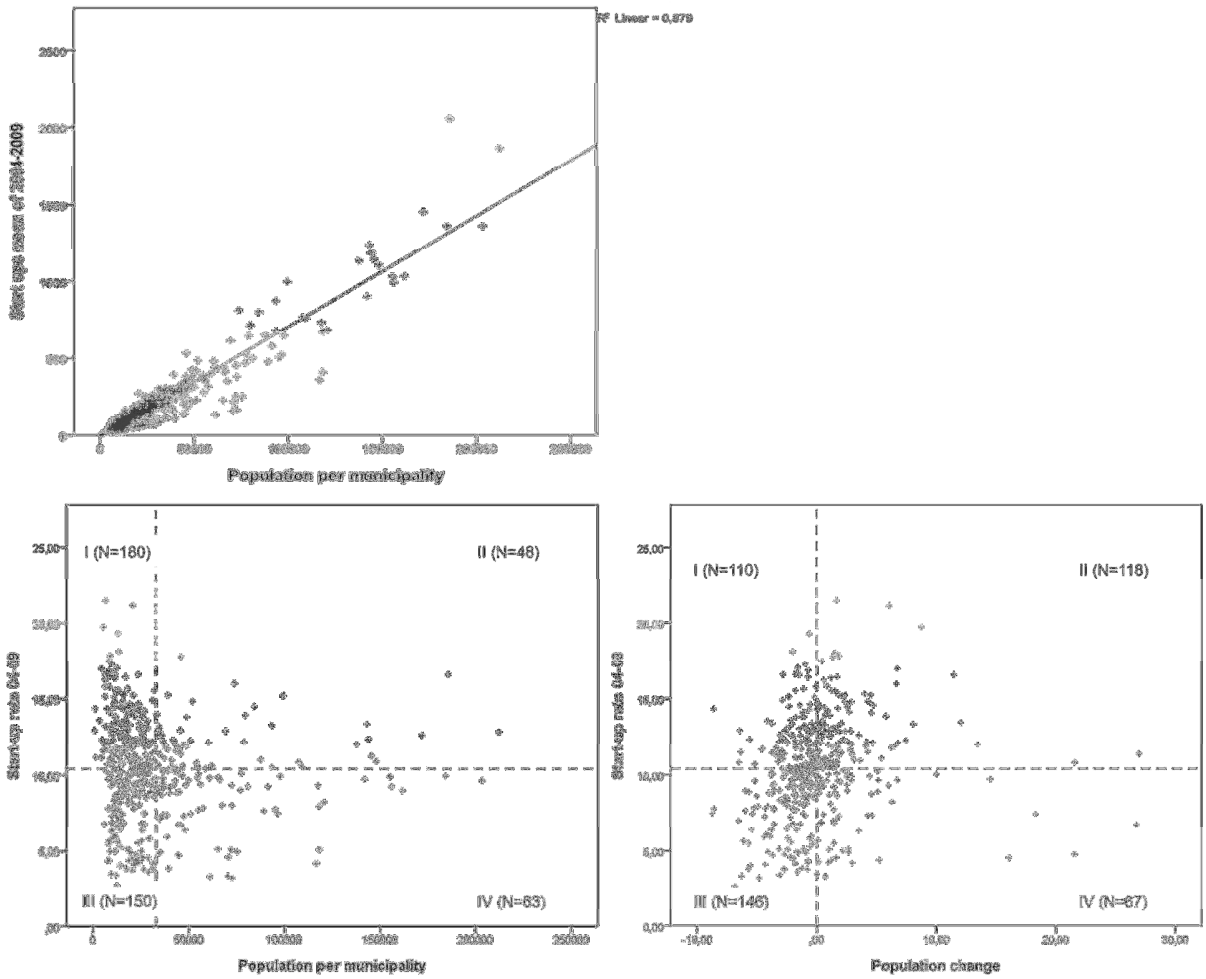

Figure 2. Top left: number of start-ups and population size. Bottom left: start-up rate and population size. Bottom right: start-up rate and population change.

Urbanization descriptives

The lack of any clear-cut picture regarding the relationship between entrepreneurial start-up rates and regional population size and changes, along with theoretical arguments which point in different directions (SER 2011; Wennekers 2006), therefore calls for a more detailed decomposition of the regional context. Figure 3 shows the correlation between population change in five categories and the NFF start-up rate, with localities split into urban and rural regions (see also Appendix A). This allows us to provide a more

the national average than do large regions (48/63), whereas fewer declining municipalities appear to out-perform the national average start-up rates than do larger regions (110/146) compared to growing municipalities (118 over 67). These inferences however needed to be treated with caution because of the MAUP Modifiable Areal Unit Problem.

fine-grained sense of the nature and strength of the relationship between NFF and population change in different contexts. It is clear that there is no simple linear relationship between population change and NFF rates, when aggregated across all regions. For both urban and rural regions, what we observe is something of a sigmoid pattern which is also heavily attenuated at greater levels of population change.

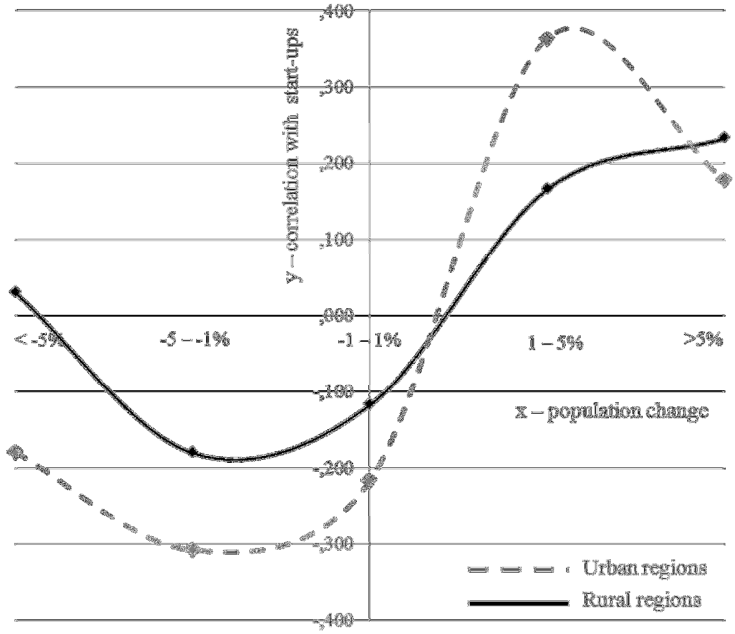

Figure 3. Pearsons correlations Population Change and NFF for rural and urban regions

The effects appear more marked for urban regions, suggesting that cumulative or endogenous effects may be more prevalent in this context (Frenken and Boschma, 2007). In terms of new firm formation, what we see is that moderate population growth or decline of +/- 1%-5% is most strongly correlated with NFF rates, giving correlations of more than +/- 0.3 in case of urban regions, and +/- 0.2 in the case of urban regions, whereas rapid population growth or decline rates of +/- 5% have a smaller association with start-up rates. Clearly the relationship between NFF, population change and regional types is rather more complex than many existing descriptions suggest, and we therefore now move to a more detailed analysis of the nature of these relationships

Multiple regression analysis

There are many factors other than population change that determine the level of new firm formation. To gain insight into the real relation between new firm formation and our explanatory variables, we needed to control for these other influences. The regression model below takes a closer look at the impact of the

changing population, the degree of urbanization and the interaction between the two. This section discusses the estimation results in general first, before returning to the main variables of interest.

Table 2 presents four models, two OLS regressions and two spatial lag regression models of start-up rates as a function of a series of explanatory variables. Because of likely spatial dependence among the small regional entities, we used the robust Lagrange Multiplier to test whether a spatial lag (LM^r_ρ) or spatial error model (LM^r_λ) is more appropriate to describe the data (Anselin, 1996). The LM test indicated that the spatial lag model was the most appropriate model to estimate. The fit of the model improved from R^2 0.29 in Model 1 to 0.71 in Model 4, confirming the spatial lag to be a good fit. The VIF remained under 5, indicating that multicollinearity is not a problem (Haan, 2002). The spatial autoregressive coefficient (*W_DEPENDENT*) is estimated at 0.73 in Model 4 and is highly significant. This is means that the explanatory power of the variables in the model are, to some extent, caused by neighbouring municipalities; more specifically, high new firm formation in neighbouring municipalities is associated with higher rates in the base region. In other words, there was a spatial effect on a higher aggregated level than the municipality level present.

All models presented in this paper show fairly robust results for the control variables: an aging society affects new firm formation negatively, as does a decrease of young people in the region. Growing household size is positively related to new firm formation all four models, and the same applied for the share of highly educated people in the local population. The proportion of migration and unemployment rates did not seem to have any significant influence on start-up rates, while municipality income levels are strongly positive. Also, we found that the service sector had a significant positive effect on start-up rates, as does the intensity of competition measured by the Herfindahl index, which as expected is significantly negative throughout. Finally, neither the public sector nor the voting turnout used as proxies for the institutional context were statistically significant.

DEP. New firms per 1000 potential workers	**Model 1**	**Model 2**	**Model 3**	**Model 4**
	OLS 1	OLS 2	Spat. lag 1	Spat. Lag 2
	B(SE)	B(SE)	B(SE)	B(SE)
W_DEPENDENT			0.74 (0.03)***	0.73 (0.03)***
LEVELS OF DECLINE				
STRONG_DECLINE	-2.25 (1.01)**	-4.13 (1.37)***	-0.34 (0.64)	-1.66 (0.87)*
DECLINE	-1.12 (0.39)***	-1.73 (0.51)***	-0.25 (0.25)	-0.51 (0.32)
Stable	*Ref*	*Ref*	*Ref*	*Ref*

GROWTH	0.79 (0.34)**	-0.03 (0.45)	0.38 (0.22)*	-0.10 (0.29)
STRONG_GROWTH	1.45 (0.52)***	0.52 (0.69)	0.32 (0.33)	-0.32 (0.44)
DEGREE OF URBANIZATION				
RURAL	1.83 (0.33)***	0.73 (0.54)	1.78 (0.21)***	1.13 (0.34)***
Intermediately urban	Ref	*Ref*	*Ref*	*Ref*
URBAN	-1.65 (0.46)***	-3.16 (0.76)***	-1.39 (0.29)***	-2.21 (0.48)***
INTERACTION VARIABLES				
*Strong_Decline*Intermediate*		*Ref*		*Ref*
*STRONG DECLINE*RURAL*		4.80 (2)**		3.39 (1.27)***
*STRONG DECLINE*URBAN*		0.32 (3.2)		-0.14 (2.03)
*Decline*Intermediate*		*Ref*		*Ref*
*DECLINE*RURAL*		1.42 (0.83)*		0.56 (0.53)
*DECLINE*URBAN*		1.34 (1.09)		0.62 (0.69)
*Growth*Intermediate*		*Ref*		*Ref*
*GROWTH*RURAL*		1.27 (0.77)*		0.87 (0.49)*
*GROWTH*URBAN*		2.95 (0.97)***		1.49 (0.62)**
*Strong Growth*Intermediate*		*Ref*		*Ref*
*STRONG GROWTH*RURAL*		1.96 (1.23)		1.4 (0.78)*
*STRONG GROWTH*URBAN*		2.81 (1.34)**		1.72 (0.85)**
CONTROL VARIABLES				
UNDER_15	-0.18 (0.24)	-0.27 (0.24)	-0.2 (0.16)	-0.26 (0.15)*
OVER_65	0.31 (0.2)	0.29 (0.2)	-0.2 (0.13)	-0.21 (0.13)*
HOUSE_SIZE	8.02 (4.81)*	9.48 (4.82)**	5.15 (3.06)*	6.29 (3.06)**
HIGH_EDU	0.07 (0.02)***	0.06 (0.02)***	0.06 (0.01)***	0.05 (0.01)***
IMMIGRANTS	-0.04 (0.13)	-0.02 (0.13)	0.07 (0.08)	0.08 (0.08)
INCOME	32.11 (6.46)***	32.4 (6.43)***	16.55 (4.12)***	16.61 (4.08)***
UNEMPL	0.13 (0.09)	0.11 (0.09)	-0.02 (0.06)	-0.02 (0.06)
SERVICE	0.01 (0.02)	0.01 (0.02)	0.02 (0.01)**	0.02 (0.01)**
HERF_INDEX	-17.66 (5.6)***	-16.21 (5.6)***	-11.49 (3.57)***	-11.06 (3.56)***
INSTITUTIONAL CONTEXT				
PUBLIC_SEC	0.06 (0.03)*	0.06 (0.03)	0.02 (0.02)	0.02 (0.02)
VOTING	-0.06 (0.04)	-0.06 (0.04)	0.03 (0.02)	0.03 (0.02)
N	441	441	441	441
R square	0.29	0.32	0.70	0.71
LM_ρ	348.33***	342.99***		
LM^r_ρ	46.84***	59.90***		
LM_λ	307.48***	286.32***		
LM^r_λ	5.98**	3.23*		

Table 2. Regression results

Levels of population decline

In general, the results show that population change related is indeed related to the rates of NFF in each region, although these relationships differ markedly and largely systematically depending on the context and also the types of population change which are evident. Regions facing declining or strongly declining populations exhibit lower new firm start-up rates, but maybe rather surprisingly, the role of population growth in NFF appears limited to only the first and most basic model specification. This implies that the relationship between population change and new firm formation appears to be primarily formed by the negative impact of decline and not by the positive effects of growth; entrepreneurship of necessity rather than entrepreneurship of opportunity. However, a more nuanced picture is provided by including the additional effects of interactions between population change and the degree of urbanization, illustrated by Figure 4. Even though a growing population alone does not generate a significant effect, the interaction term shows that in urban and rural municipalities, population growth has a positive impact on start-up rates as compared with intermediately urban regions. It shows that population decline is not negative by definition and nor does growth have a positive effect in all cases. The picture is very mixed.

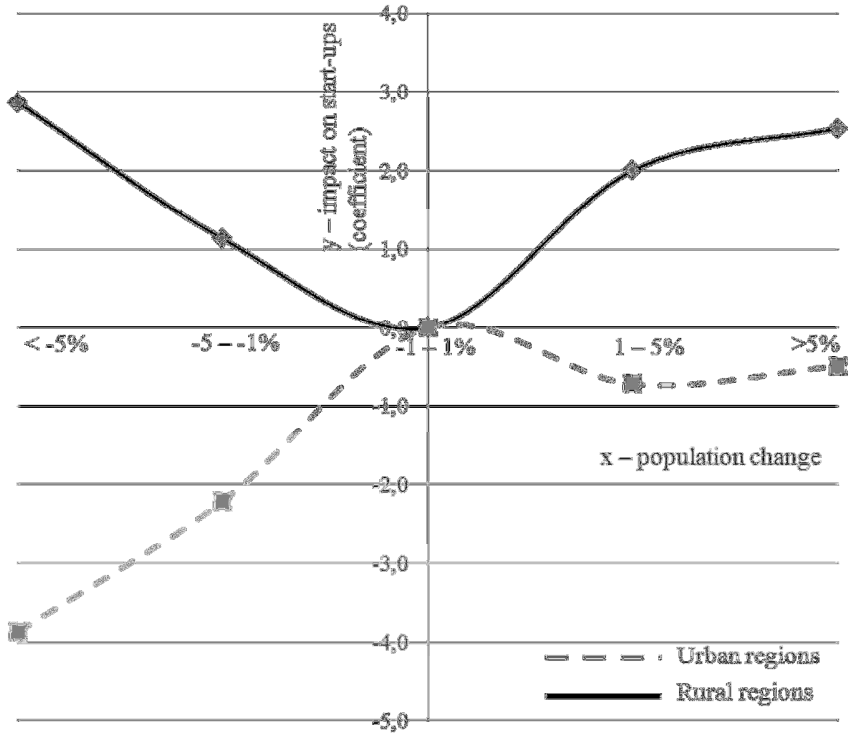

Figure 4. Significant outcomes of the regression model tallied up (coefficients with regards to the reference category intermediate and stable regions).

Urban and rural

As we see in Table 2, across all four models and across all types of regions, population decline appears to be more strongly associated with falling NFF rates than population growth is associated with rising NFF rates. More specifically, when compared to the baseline intermediate region, we find that rural regions systematically exhibit higher NFF rates, while urban regions systematically exhibit lower NFF rates. Moreover, this general picture is also largely maintained when we control for all of the interaction effects between regional types and different degrees of population change. Having said that, in terms of NFF rates, urban regions do appear to be particularly responsive to positive population growth, whereas rural regions appear to be more responsive to population decline.

Figure 4 shows the cumulated significant coefficients of the degree of population change, the regional context and the interaction effect of both (all with regard to the reference categories *INTERMEDIATE* and *STABLE*). The horizontal axis represents the reference categories; both lines are set out to the x-axis. The figure shows the size of the gap between urban and rural regions. The positive effect of rurality is so strong that it completely eliminates the negative impact of strong decline. Relatively speaking, compared to intermediate regions facing (strong) decline, rural regions do much better than urban areas; the impact of population change is the largest in rural regions. This can be partially explained by a denominator effect, but for the declining regions a strong development of necessity-driven self-employment is also likely. The start-up rates do not take firm growth potential into account and the survival rate is not incorporated in this measurement. Therefore, it is possible that the formation of new firms in declining rural regions is strongly influenced by serial self-employment.

Rural regions then show a positive relation with population growth in terms of new firm formation, the positive effect of which may also be related to selective migration. Cottage industry is a good illustration of this phenomenon: nascent entrepreneurs relocated their home to the urban periphery and start an – often part-time – business from their home. Cottage industries are less dependent on agglomeration benefits. Also, in a remote village with a growing population it is more common to start a small business or shop from home. It is likely these new firms in rural municipalities are rather small.

Urban municipalities mirror rural regions almost exactly: the overall effect of population change in urban regions is negative over all degrees of change. The negative impact on new firm formation of urbanization corresponds with the findings of Van Stel and Suddle in 2008 for the Netherlands, but is rather different to the findings in many other countries (Sternberg, 2011). It appears that urban regions in the Netherlands have already achieved the maximum benefit from agglomeration effects. Another

potential explanation may lie in the presence of a service sector that is less reliant on agglomeration benefits. It is also important to note that our results must be interpreted with regard to the reference categories, the intermediately urban regions. In the Dutch context, this means that urban areas lose a significant number of start-ups to the intermediate urban regions, which may largely explain the negative results. The surrounding intermediate regions of the Randstad area are highly competitive in housing prices and availability, provide similar facilities to the urban areas and appear to offer more entrepreneurial opportunities.

Conclusion

The main goal of this paper has been to analyse the empirical relationship between new firm formation and population change in different regional contexts. Data from the LISA database and Statistics Netherlands over the period 2003-2009 was used to test the relationship. We have used multiple regression models including spatial econometric techniques for the case of 441 municipalities in the Netherlands. We find that population change is indeed positively related to the rate of new firm formation, but the effects of population change differ both according to the regional context and also to the nature and scale of the population changes. Nevertheless, our results did show two different types of relationship. Population growth is not positive per se for NFF rates, and neither is population decline necessarily negative for NFF. The regional context determines the relationship.

Population decline in rural regions did not show the expected negative impact on new firm formation. For rural regions, both strong decline and moderate decline actually showed a strong positive impact on start-up rates, suggesting that these start-up rates are in response to the minimum levels of supply of services and activities which are needed in rural regions regardless of a declining population. The results also suggest that mild population decline is actually less inductive for new firm formation than stronger decline exceeding 5%. Thinking in terms of demographic transitions, this suggests that when a rural region first experiences population decline, the focus tends to be on the negative aspects, but when the decline continues many rural regions appear to adjust to the adverse shocks by increasing entrepreneurship: something of a classic Schumpeterian story.

The relationship between new firm formation and population change is rather different in urban regions. Urban areas have a negative impact throughout. There are argued to be many economic benefits associated with urban context, and entrepreneurial opportunities and systems are often discussed in the literature as being key urban advantages. However, our results paint a quite different picture. Dutch urban areas are systematically weaker in terms of new firm formation rates than rural or intermediate areas, and

they are also less responsive to adverse population shifts. In terms of entrepreneurial activities, they appear to be primarily only strongly responsive to population growth.

In conclusion, we find a clear distinction between regional contexts in the impact of degree of population change on new firm formation. In light of this conclusion, the regional context and the severity of decline should be taken into account when determining the kind of coping mechanism that is needed for dealing with the consequences of decline. Important questions beyond the scope of this current paper also arise. How can the well-being of the inhabitants of declining regions be guaranteed despite decreasing amenities? And, can entrepreneurship contribute to building or maintaining a resilient region? In the Netherlands this is not yet a pressing matter, but given the forecasts of future population decline, it will become increasingly relevant. The focus of this paper was on new firm formation, to which a follow-up question might be: what is the economic impact of these new firms within the declining regions? Having found a positive impact of declining rural regions on start-ups, it would be interesting to know whether these new firms grow beyond the lone self-employed businessmen with perhaps one or two employees, and whether they serve the local market or export their products or services. Also, from the data available for this paper it was not possible to determine who the new entrepreneurs are and what their motivations are for start-up. It is likely that motivations in a declining region differ from those in a growing region. Are there indeed more necessity-driven entrepreneurs in declining regions, and opportunity-driven entrepreneurs in growing regions? Future research is required in order to answer these questions.

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Appendix A.

	NFF all regions	NFF in rural regions	NFF in intermediate regions	NFF in urban regions
Strong Decline	-,095**	,030	-0,195***	-,179
Decline	-,208***	-0,188**	-0,222***	-0,308***
Stable	,006	-,117	0,121*	-0,216*
Growth	,142***	0,166*	,061	0,364***
Strong growth	,108**	0,232***	0,116*	,178
N	441	128	238	75