How to attract STEM workers to a high-tech business park in a shrinking region?

Place and life satisfaction

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Abstract

Despite the importance of STEM workers to the vitality of the regional economy, scientist and policy-makers have a limited understanding of why this target group prefers to reside in certain areas. This study explores the impact of characteristics of municipalities on the overall life satisfaction of STEM workers. We use the case of a high-tech business park in a shrinking region in the periphery of the Netherlands to give some clues how municipalities can make living conditions attractive for STEM workers. Relative to non-STEM workers, STEM workers seem to prefer to live in – what we call – *places of low extraversion*. This is illustrated by the finding that an increase in the number of amenities and businesses in the municipality they live makes them less happy. To attract STEM-workers local policy makers and spatial planners should focus on the quality of life in suburban areas, which are often characterized by quiet, green and open areas and with low exposure to consumption and production hubs.

Keywords: Life satisfaction, settlement patterns, STEM workers, high-tech business park, periphery

Introduction

Academic and policy interest in attracting and retaining highly skilled and educated people for one's national and regional economy has been growing over time. Special attention has been paid to creative and knowledge-intensive sectors. In some cases, this attention is based on revitalizing regions that have been challenged by the disappearance of old, often primary industries such as the mining industry. The disappearance of such industries has profound consequences for the economic structure and demographic composition of a region, due to falling employment and demographic shrinkage. Hence, once industries become economically unviable, alternative responses have to be found and new business activities should be searched for (see, for an example, Jeannet and Schreuder, 2015).

In exploring the drivers of regional development, much attention is paid to the impact of research and development (R&D) and the people occupied in the fields of science, technology, engineering or mathematics – hereafter called as STEM workers - as it is assumed that they represent the engine of innovation (Dahl and Sorensen, 2010; Scott, 2006; Musterd et al. 2016; Carnevale et al. 2011). Hence, people occupied in one of these fields do not only represent a vital component to regional innovation by generating new ideas, but are also a key driver of employment growth. Despite the importance of STEM workers to the regional economy and vitality, scientist and policy-makers have a limited understanding of where this occupational group would like to reside. Studies on location choice are dominated by the main stream literature that recognizes urban areas, its economic opportunities, amenities and vibrant life style as main attractive force (E.g. Glaeser et al. 2001; Clark et al. 2002). Previous studies on the living preferences of the technical working force however show that this specific group prefers a living area other than urban environments (Boterman and Bontje, 2016; Scott, 2010; Florida, 2002; Kotkin, 2000). A further understanding of the locational preferences of STEM workers could support policy-makers to develop the instruments needed to attract this particular target group to specific areas.

Based on their utility function individuals tend to choose the place of residence by maximizing the individual well-being in sequential investments. The benefits of settling down in a certain place outweigh the costs and individual preferences are satisfied at the highest level. The choice for a particular residential location therefore becomes the key for individuals to find the geographical area that best fits their preferences and thus fulfil their desires (Tiebout, 1956; Sjaastad, 1962; Harsanyi, 1982; Kahneman et al. 1999). Henceforth, more choice allows individuals to satisfy more of their preferences and to generate a higher utility. By doing so, individuals reveal their utility and preferences.

Given the individual preferences, location choices are often based on a combination of hard and soft locational factors a particular area has to offer, such as the availability of jobs or consumer amenities (see, for example, Rijnks et al., 2016). These locational factors are objective indicators and often explored in studies regarding place attraction and place selection. We contribute to the literature on location choice by not primarily focusing on these revealed preferences, but instead analysing life satisfaction to understand location choices of individuals. Life satisfaction[1] is one of the ingredients

[1] This study measures life satisfaction as a proxy to analyze the hypothesis. We use the terms life satisfaction, happiness, well-being and the quality of life interchangeably in this paper.

in the utility function that can capture individuals' actual experiences in a direct manner. The potential value of measuring subjective well-being has been emphasized on in policy and academic settings over the last decades (Diener and Seligman, 2004 and Dolan et al. 2008).

Touching upon recent studies on place attraction, place selection and life satisfaction, this study argues that the distance to work, amenities and demographic characteristics in a municipality are likely to have an impact on individual life satisfaction (Florida et al, 2013; Florida, Mellander and Stolarick, 2008; Glaeser, Kolko and Saiz, 2001; Morrison, 2007, 2011). This study uses life satisfaction as a tool to explore the settlement patterns of STEM workers. It argues that an individual's own evaluation of life satisfaction indicates the features of the geographical unit in which they reside. Linking life satisfaction to place is not something novel and is explored by different disciplines (see, for example, Easterlin, 1974; Kahneman et al. 1999). While (cross)-national studies have stressed the topic of life satisfaction and place (often in relation to economic indicators), relatively few studies have addressed the impact of life satisfaction on a smaller geographical scale such as on a municipality level (Morrison, 2011; Shields et al, 2009; Shields and Wheatley Price, 2005). There is yet a clear gap on what impact a place and its aspects have on individuals' life satisfaction. To the best of our knowledge no previous studies have explored the possibility that life satisfaction of a specific occupational group such as STEM workers is important for the geographical settlement pattern. In particular, these STEM workers are relevant for policy makers since they are a decisive input factor to stimulate regional economic development.

The hypothesis of this study is tested through a statistical analysis of the effects of the distance to work, amenities and the demographic characteristics of one's municipality on individual life satisfaction. The results of this study show that the average STEM worker, relative to the average non-STEM worker, prefers to reside in a place with a short commuting distance, with a young and wealthy social composition of the population and without much emphasis on production and consumption. The results outline an image that corresponds to a suburban living environment.

The paper is structured as follows. The second section provides a conceptual framework of theories and empirical findings from previous studies on place and life satisfaction. The data analysed, the main variables of interest and a model specification is described in the third section. The results of this study are outlined and discussed in the fourth section. Section 5 concludes and discusses some policy implications.

Conceptual framework

Our analysis builds upon theoretical frameworks and empirical studies in life satisfaction and location choice of individuals. The independent variables incorporated in the regression are identified to have an explanatory potential for overall life satisfaction or have been shown to play a role in the explanation of why people choose a certain place to reside. This study considers a varied range of measures on life satisfaction and place.

Distance. Research shows that commuting does affect ones happiness and satisfaction. The OECD (2010) reports that the average commuting time in the Netherlands is longer than in other European countries. The data used by the OECD stems from the European Survey Working Conditions (2005) that reveals that the largest group of workers in the Netherlands commute between 40 to 60 minutes daily. Other countries with such large groups of long-distance commuters are Hungary and Great Britain. Stutzer and Frey (2008) find a negative effect on commuting time and life satisfaction using panel data on subjective well-being for Germany. For individuals living in the UK Künn-Nelen (2016) finds that longer commuting times are related to a lower health status and satisfaction. Kahneman et al. (2004) find that happiness is lowest when commuting compared to other daily activities such as socializing and shopping. This is in contrast with a study of Olsson et al. (2013) who find a positive association between life satisfaction and commuting in different urban areas in Sweden. One of the arguments they make to explain the findings is that in Sweden and some other European countries it is more common to cycle or walk from home to work which contributes more to satisfaction than driving to work or using public transport. In addition, for the Netherlands Boterman and Bontje (2016) show that technical workers value shorter commuting distances more than creative workers and other higher-educated workers. Dahl and Sorensen (2010) find that Danish technical workers put very high value on the commuting distance.

Amenities. In recent years, a growing number of studies – especially focusing on the American context - have suggested that amenities in geographical areas such as theaters, restaurants, nightlife and entertainment play an important role in the ability to attract people and businesses (Glaeser, Kolko and Saiz, 2001; Florida 2002a, 2002b; Clark et al. 2002). Sleutjes (2013) finds that soft factors such as amenities seem to be of less importance for knowledge workers in Europe than in the USA. Sleutjes (2015) however finds it plausible that amenities will play a part once the choice for a work area has been made. Scott (2010) finds that amenities do not play a role in the location choice of engineers in the USA. Boterman and Bontje (2016) find that technical workers are less inclined to consider (urban) amenities such as restaurants and museums as important than creative workers and other higher-educated workers in the Netherlands.

Income. Clark, Westergård-Nielsen and Kristensen (2009) find that local income rank is positively correlated with economic satisfaction. A study by Dittmann and Goebel (2010) shows that life satisfaction increases when one resides in a neighbourhood with a higher socioeconomic status. Knies (2011) finds that movers value living in richer neighbourhoods. It can be assumed that a richer neighbourhood is expressed in visible consumer goods, such as the architecture of houses or the type of cars parked in the street. Non-movers show however to become less happy if their neighbours are getting wealthier (Knies, 2011). Knies (2011) finds a negative neighbourhood income effect for West Germany which means that people derive their satisfaction based on a comparison with another one's income. This result is even more emphasized by limiting the sample to

respondents living on residential streets. For the latter, it is assumed that social bonds between neighbours are more tied. A higher average income of a municipality may explain the quality of life in a municipality. Also, higher income groups may feel more satisfied with life when enjoying more consumption goods and a higher status. Higher spending may at the same time contribute to an economically flourishing municipality.

Cultural diversity. There are different views on whether (sub) cultural diverse backgrounds have a positive effect in geographically small spatial areas. One of the views is that ethnic concentrations in small spatial areas such as a neighbourhood would have a negative impact on the integration of minorities. Immigrants would have a limited contact with natives, creating different perceptions and limited possibilities to speak the language of the receiving country. Another view is that a culturally diverse community should be applauded because it increases social processes in a positive way and henceforth perform better than a more homogeneous community (see, for examples, Dagevos, 2014; Musterd et al. 2011). Other studies stress the importance of openness and tolerance in attracting human capital to places. Also, the openness to creativity and diversity in a region may be related to regional innovation and economic growth (Florida, 2002b; Florida and Gates, 2001). Florida and Gates (2001) and Florida (2002b) find a positive relationship between diversity (among others things measured by the percentage of ethnic diversity and gay people in a region) and the concentration of high-tech industries. The share of the population with a migrant background comprised 17.5% in 2000 and has been increasing to 22.1% by 2016 in the Netherlands. In the southernmost part of the Netherlands (South-Limburg) , this share increased from 21.9% in 2000 to 23.4% in 2016 (Statistics Netherlands, 2017).

Ageing. Demographic change is a complex challenge because of its socio-economic implications. For the US, Glaeser et al. (2016) find that declining cities appear to report lower levels of happiness than cities that are not declining. Falling birth rates, youngsters leaving a particular region and a rising number of elderly are often at the base of these demographic changes in peripheral regions. As in most OECD countries, changing demographics such as shrinking and ageing populations at the regional level resulted in changing population dynamics in the Netherlands. This is especially the case for regions situated in de Dutch periphery. The percentage of people aged 65 and over increased from 13.6% in 2000 to 18.2% in the Netherlands in 2016. In 2000, the percentage of people aged 65 and over comprised 15.5% and increased to 22.5% in the area in which the high-tech business park at stake in this study is situated (Statistics Netherlands, 2017). The demographic composition of a region represents a relevant indicator for expected economic development in the long run. Challenges are to be found in the structure of the working age population, the availability of local amenities and services and in health and social welfare challenges (OECD, 2013, 2014). Even though a consistent U-shaped relation is found between life satisfaction and age at the individual level, there is a gap in understanding what impact an increase of the elderly (65 years and over) has on the overall life satisfaction of individuals in a certain area. An elderly society may have an impact on different aspects in society. It is likely that citizens in different life stages differ in many facets because they may not identify themselves with each other and may have conflicting interests. This can for example be expressed in differences between younger generations and people aged 65 and over in terms of political perceptions. Whereas the younger generations may value political and social changes and value the integration of new technologies, elderly may be more conservative. This could cause heterogeneity in the interest of younger and older citizens in a certain area. This

may arguable push young people away from a certain area to maximize their well-being in sequential investments.

Population density. The Netherlands follows Korea among the OECD countries with the highest population density (OECD, 2013, 2014). Moreover, the peripheral province of Limburg is the second densest area in the Netherlands after the megapolis Randstad. The Randstad is a central spot in the Western part of the Netherlands which consists of the largest Dutch cities Rotterdam, Amsterdam, The Hague, Utrecht and their surroundings (Statistics Netherlands, 2017). Kotkin (2000) states that workers in technical occupations in the US, such as those employed in the high-tech professions in Silicon Valley prefer to reside in areas other than dense urban areas. The same is found by Boterman and Bontje (2016) who show that technical workers prefer a more suburban environment to live in. Studies on the effect of population density on life satisfaction show however various outcomes. Florida et al. (2013) find that denser places are related to lower levels of happiness while controlling for wages. The same is true for a study of Sørensen (2014) who, using data from the European Value Study (2008), finds a higher life satisfaction among European rural dwellers than people living in cities. Shucksmith et al. (2009) find small rural-urban differences in the quality of life in richer European countries such as Luxembourg, Germany and the Netherlands.

Data, variables and model specification

Data

This study is based on using unique survey data collected in different companies at a high-tech[2] business park in the southernmost part of the Netherlands. The data collected between April 2015 and April 2016 includes information on 736 individuals. We incorporate specific characteristics of municipalities by merging our survey data with data of the district and neighbourhood map (Wijk- en buurtkaart) published by Statistics Netherlands (2015). Information on the average income per inhabitant stems from the 2014 district and neighbourhood map provided by Statistics Netherlands. Other indicators at the neighbourhood level are drawn from 2013 data of Statistics Netherlands.

Dependent variable

To be able to capture overall long-term well-being this study uses life satisfaction as a measure. According to previous studies the measure of self-rating life satisfaction gives a stable evaluation of individual happiness (Helliwell and Putnam, 2004; Diener et al. 2003). The question used for measuring life satisfaction is as follows: "All things considered, how satisfied are you with your life as a whole these days?" The possible responses are ordinal in nature and have a scale from 0 to 10. This question has been widely used as a measure of individual satisfaction and well-being. Note that the life satisfaction scale ranges from 1 to 11 in the analysis, respondents however have seen the scale from 0 to 10 in the survey.

Control variables

The set of control variables captures age, age squared, gender, marital status, nationality, highest educational level attained, children living at home, the money spent on the dwelling each month and income.

Independent variables

We employ a range of independent variables. Except for the distance from home to work all independent variables are based on data from Statistics Netherlands (2013, 2014 and 2015). These variables are interacted with whether one has a STEM occupation (1) or not (0). The variables are continuous and are centered subtracting the mean from each variable. Doing so, each variable is assigned a zero mean. Note that it does not change the interpretation of the model.

The independent variables are classified using the division of Local Administrative Units (LAU 2). This is a subdivision of the Nomenclature of Territorial Units for Statistics (NUTS 3). The explorative variables are based on the features of a municipality rather than on the characteristics of a neighbourhood[3]. This is firstly done because there is limited evidence for neighbourhood effects in the Netherlands (Dagevos, 2014, p.83). Secondly, municipalities are a relevant level of analysis when

[2] This high-tech business park is a leading innovation hub that transformed itself from the coal mining industry in the mid-20th century to a biotech plant(s) present-day. It is situated in the Dutch periphery and is close to the borders of Germany and Belgium (Hooijen and Cörvers, 2015; Jeannet and Schreuder, 2015).

[3] We do also recognize the relevance of an analysis on the neighbourhood level, the N of the subgroups in the dataset used is however too low to draw any conclusions from.

considering policy recommendations and interventions in the Netherlands, which is less so for neighbourhoods.

Three different groups of variables are distinguished in the model:

(1) Distance

The distance in kilometers from home to the campus is calculated using home postal codes as well as the postal code at the campus. This is followed by a calculation of coordinates downloaded using google maps.

The distance between home and the first main road accessible is based on the home postal codes and the average distance of all residents in a municipality to the nearest main road.

(2) Amenities

The number of companies shows the number of business establishments in a municipality.

The average number of restaurant and cafes is based on the average number of amenities such as coffee houses, coffee shops, nightclubs, food deliveries at home within a radius of 1 kilometer from home.

(3) Demographic characteristics

The average income of the municipality is calculated by using the annual personal income of individuals.

The percentage of cultural diversity is calculated bydividing the number of persons who at least have one parent who is not born in the Netherlands by the entire population in a municipality.

The ageing variable shows the percentage of people aged 65 and over in a municipality.

Population density shows the number of inhabitants per square kilometer. This is calculated by dividing the population by the land surface.

Table 1 Descriptive statistics

Variable	Sample STEM workers mean	SD	Min	Max	Sample non-STEM workers mean	SD	Min	Max	Total sample	SD	Min	Max
Life satisfaction	8,93	1,17	1	11	9,03	1,16	1	11	8,87	1,18	3	11
Age	47,36	10,69	23	64	48,21	9,84	27	64	46,84	11,16	23	64
Age squared	2356,69	978	529	4096	2420,49	922,3	729	4096	2318,1	1010	529	4096
Distance from home to work	18,6	15,66	1,2	109	17,94	17,31	1,5	109	18,99	14,59	1,2	74,4
Distance from home to the nearest main road	1,67	0,45	0,6	4	1,62	0,41	0,9	2,7	1,7	0,47	0,6	4
The number of businesses	4272,1	3205	475	18400	4020,42	3118	475	18400	4424,3	3252,6	475	18400
The average number of restaurants and bars in a radius of 1km2	5,02	3,23	1,55	12,55	4,71	2,94	1,55	12,55	5,22	3,38	1,55	12,55
Average annual income per inhabitant in a municipality [x1000]	22,43	1,17	20,2	28,9	22,55	1,34	20,2	28,9	22,36	1,05	20,2	25,7
% cultural diversity	10,16	3,19	4	24	9,94	2,86	4,5	16	10,3	3,37	4	24
% people aged 65 and over	21,85	1,87	16	27	21,93	1,82	16	27	21,8	1,9	16	27
The number of inhabitants per km2	1171,32	637,8	149	2546	1149,22	597,7	198	2546	1184,7	661,69	149	2546
N	258				156				414			
	62,32%				37,68%							

Note: SD, standard deviation
Dependent variable: life satisfaction on a scale from 1-11

Table 1.1 Descriptive statistics

	STEM	Non-STEM	All respondents
Variable			
Male	86,43%	37,72%	81,64%
Female	13,57%	26,28%	18,36%
No Partner	15,89%	11,54%	14,25%
Partner	84,11%	88,46%	85,75%
Non-Dutch	13,57%	5,77%	10,63%
Dutch	86,43%	94,23%	89,37%
Educational level low	34,88%	29,49%	32,85%
Educational level medium	39,15%	46,15%	41,79%
Educational level high	25,97%	24,36%	25,36%
Children living at home yes	49,61%	62,18%	54,35%
Children living at home no	50,39%	37,82%	45,65%
Monthly expenses of dwelling <400€	20,93%	14,74%	18,60%
400€-699€	34,88%	28,85%	32,61%
700€-999€	25,19%	28,21%	26,33%
1000€-1500€	15,89%	21,15%	17,87%
>1500€	3,10%	7,05%	4,59%
Monthly gross income<2500€	9,69%	9,62%	9,66%
2500€-4500€	52,33%	45,51%	49,76%
4500€-6500€	31,78%	26,28%	29,71%
>6500€	6,20%	18,59%	10,87%
N	258 62.32%	156 37,68%	414

Model specification

We run an ordinary least square (OLS) regression to examine the effects of (commuting) distance, specific demographic variables and the number of businesses and amenities in municipalities on the overall life satisfaction of STEM workers. The estimated effects are based on robust standard errors, clustered by municipalities. This specifies that the observations may be correlated within the municipalities, yet would be independent across the municipalities (Cameron and Trivedi, 2009).

The main model we estimate is

$$\mathrm{LS}_{\mathrm{gi}} = \beta_0 + \beta_1 X_{gi} + \beta_2\, Z_{gi} + \beta_3\, Z_{gi} * \left(STEM_{gi}\right) + \varepsilon_{gi}$$

where observations belong to municipality g = 1,…N and observations are indexed by i = 1,…,M within their municipality, where M is the number of observations per municipality. $\mathrm{LS}_{\mathrm{gi}}$ denotes the dependent variable, i.e. individual life satisfaction. β_0 is the intercept. X_{gi} is a vector of control variables likely to influence life satisfaction (age, age squared, gender, partner, nationality, educational level, children living at home, monthly expenses dwelling and monthly gross income). Z_{gi} denotes a vector of more specific variables contributing to the main focus of this study (divided into distance, amenities and demographic characteristics). $STEM_{gi}$ is a dummy indicating whether the individual i within municipality g works in a STEM occupation. ε_{gi} is the error term.

Robustness checks

The results of the OLS regression are robust running an ordered probit model. Robust results are furthermore found when controlling for different domains (income, social network and health) within life satisfaction that have shown to be robustly associated with overall life satisfaction.

Results

Table 1 estimates how the characteristics of the municipality where the individual is living are associated with one's overall well-being using an OLS regression as well as an ordered probit model. For the OLS regression using a stepwise approach, please see Table 1 of the Appendix. Table 2 presents the results of an OLS regression using extra control variables within the life satisfaction domain.

Table 1 OLS and ordered probit regression results on life satisfaction.

Life satisfaction	**Full Model OLS**	**Full Model Ordered Probit**
Control variables		
Age	0.0531	0.0157
	(0.0519)	(0.0458)
Age squared	-0.000527	-0.000156
	(0.000589)	(0.000516)
Gender (female)	0.253	0.187
	(0.304)	(0.310)
Partner (yes)	**0.251****	**0.311****
	(0.115)	(0.145)
Nationality (Dutch)	0.194	0.206
	(0.205)	(0.208)
Education medium (ref: low)	**0.205***	0.141
	(0.105)	(0.0963)
Education high (ref: low)	0.405	0.297
	(0.244)	(0.243)
Children living at home (yes)	-0.0220	-0.0177
	(0.0982)	(0.101)
Monthly expenses dwelling	**-0.0648***	-0.0488
	(0.0364)	(0.0353)
Monthly gross income 2500€-4500€	0.0377	-0.0807
	(0.217)	(0.230)
4500€-6500€	0.0984	0.00116
	(0.193)	(0.221)
>6500€	**0.470****	0.434
	(0.224)	(0.277)
STEM worker	-0.00916	-0.0374
	(0.0993)	(0.0943)
Distance from home to work	0.000881	0.00250
	(0.00525)	(0.00482)
Distance from home to the nearest main road	-0.266	-0.110
	(0.349)	(0.320)
Number of businesses	6.43e-06	-7.55e-06
	(3.61e-05)	(3.25e-05)
Number of restaurants and bars in a radius of km²	0.0428	0.0270
	(0.0367)	(0.0297)
Average annual income per inhabitant in a municipality	-0.0532	-0.0724
	(0.0585)	(0.0564)

% of cultural diversity	-0.0237	-0.00942
	(0.0523)	(0.0489)
% of people aged 65>	-0.0291	-0.0239
	(0.0693)	(0.0715)
Population density	-1.92e-05	-1.32e-05
	(0.000163)	(0.000154)
Interaction Distance		
STEM worker x distance	**-0.0123***	**-0.0157*****
	(0.00617)	(0.00602)
STEM worker x nearest main road	-0.00574	-0.173
	(0.358)	(0.336)
Interaction Amenities		
STEM worker x number of businesses	**-0.000146****	**-0.000140****
	(6.31e-05)	(6.30e-05)
STEM worker x number of restaurants and bars	**-0.0777***	-0.0322
	(0.0420)	(0.0356)
Interaction Demographics		
STEM worker x average annual income municipality	**0.454*****	**0.500*****
	(0.145)	(0.155)
STEM worker x cultural diversity	**0.120****	**0.109***
	(0.0593)	(0.0567)
STEM worker x ageing	**-0.219****	**-0.241****
	(0.0910)	(0.0995)
STEM worker x population density	-1.86e-05	-0.000125
	(0.000224)	(0.000224)
Constant	**6.899*****	
	(1.136)	
Observations	414	414
R-squared/Pseudo R2	0.113	0.0447

Note: Coefficients are reported and robust standard errors in parentheses.
R-squared for OLS model + Pseudo R2 for OPM
*** p<0.01, ** p<0.05, * p<0.1

The first column of Table 1 presents the results of an OLS regression. It shows the relationship between the characteristics of a place in which an individual lives and the individual self-reported life satisfaction, controlling for individual attributes. We find significant and negative coefficients if the commuting distance increases (p<0.05). Individual life satisfaction of STEM workers also decreases when the number of companies (p<0.01), bars and restaurants (p<0.01) within ones municipality increases relative to those not occupied in the STEM field. Significantly positive coefficients are found for an increase in the average income of the municipality STEM-workers live in relative to non-STEM workers (p<0.001). The same is true for an increase in the share of a culturally diverse population (p<0.05). Lastly, a significantly negative coefficient is found for an increase in the share of people aged 65 and over. STEM-workers thus show to become less satisfied with a higher share of elderly in their municipality relative to non-STEM workers (p<0.01). The second column of Table 2 shows the results of an ordered probit model. Controlling for individual attributes, we here find similar significant results as in the OLS regression.

Table 2 OLS regression (including extra controls within the life satisfaction domain) results on life satisfaction.

Life satisfaction	**Model including extra control variables**
Control variables	
Age	0.0327
	(0.0535)
Age squared	-0.000290
	(0.000584)
Gender (female)	0.0542
	(0.208)
Partner (yes)	**0.266****
	(0.118)
Nationality (Dutch)	0.00150
	(0.167)
Education medium (ref: low)	-0.0695
	(0.0921)
Education high (ref: low)	0.105
	(0.139)
Children living at home (yes)	-0.0738
	(0.114)
Monthly expenses dwelling	0.0191
	(0.0251)
Satisfaction with income	**0.127***
	(0.0680)
Satisfaction with social network	**0.229*****
	(0.0581)
Satisfaction with health	**0.226*****
	(0.0542)
STEM worker	-0.0595
	(0.0621)
Distance from home to work	-0.000894
	(0.00358)
Distance from home to the nearest main road	0.157
	(0.171)
Number of businesses	**-6.83e-05****
	(3.02e-05)
Number of restaurants and bars in a radius of km²	0.0137
	(0.0242)
Average annual income per inhabitant in a municipality	-0.00416
	(0.0437)
% of cultural diversity	-0.0191
	(0.0354)
% of people aged 65>	-0.0513
	(0.0534)
Population density	0.000148
	(0.000127)
Interaction Distance	
STEM worker x distance	**-0.0102***
	(0.00532)
STEM worker x nearest main road	**-0.487****

	(0.212)
Interaction Amenities	
STEM worker x number of businesses	-4.15e-05
	(5.50e-05)
STEM worker x number of restaurants and bars	-0.0427
	(0.0316)
Interaction Demographics	
STEM worker x average annual income municipality	**0.337*** **
	(0.122)
STEM worker x cultural diversity	**0.0869***
	(0.0492)
STEM worker x ageing	**-0.169****
	(0.0819)
STEM worker x population density	-0.000125
	(0.000187)
Constant	**2.685***
	(1.498)
Observations	430
R-squared	0.363

Note: Coefficients are reported and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 2 presents the results of a simple linear regression including extra control variables in the life satisfaction domain that have shown to be robustly associated with overall life satisfaction. We replace the actual income variable with the variable indicating the satisfaction with one's income. Furthermore, satisfaction with social network and satisfaction with health are included. The coefficients indicate the same results as the models shown in Table 1, yet the interaction variables with amenities lose their statistical significance.

Conclusion and policy implications

This paper has argued that an individuals' evaluation of life satisfaction is related to features of the geographical unit in which they reside, assuming that individuals make utility-maximizing decisions given their constraints. It is hypothesized that the distance to work, amenities and demographic characteristics in a municipality are likely to have an impact on individual life satisfaction. In view of this, the results of the overall life satisfaction of STEM workers allows for preferences to be identified. By using life satisfaction as a tool, this study captures individual actual experience in a direct manner, while objective indicators, such as the number of consumer amenities or the availability of jobs do so indirectly (Diener and Seligman, 2004). The results of this study demonstrate that the analysis of individual life satisfaction in relation to place characteristics offer a useful complement compared to the more obvious approaches in location choices.

The present study investigates the impact of municipality characteristics on the overall life satisfaction of STEM workers. We use the case of a high-tech business park in a demographically changing region in the southernmost part of the Netherlands. In light of increasing ageing and cultural diversity and a changing number of amenities and services, it is especially important to investigate how these changes impact the overall individual life satisfaction of the target group in this study. This is especially relevant as most studies and place-based policies emphasize a vibrant lifestyle, consumption-based amenities and personal services as an attractive factor for (highly skilled) knowledge workers to regions as well as for regional development and innovation.

The results of this study show that the social composition of a municipality, the quality of life in the area one settles down, a short commuting distance and an area which is not a place for consumption and production play a role in the location preferences of STEM workers, in contrast to non-STEM workers. Let us refer to these places as low "*extravert places*". The characteristics of a municipality and its ambiance play a role in attracting STEM workers to these places. The individual utility function, preferences and the meaning attached to a place is what creates their lifestyle.

The outcomes of this study show that there is a connection between different aspects of a place on individual life satisfaction. Untangling the reasons for the different outcomes between STEM and non-STEM workers calls however for further empirical and conceptual research. This may encourage future research on the underlying causes and influences of place attraction and the effects it generates on different (sub)-groups and their life satisfaction. Further developing the measurement of such influences, their underlying causes and their magnitude is very useful for (local) governments aiming to improve citizens' overall well-being. Even though the results of this study are of explorative nature, it does raise relevant insights about the question how to attract (a specific group of) people to shrinking regions.

The results of this study are an input for policy-makers as it implicitly calls for attention for a different view about how different geographical territories can maximize citizens' benefits in the place they reside. Measuring life satisfaction has shown to be a useful tool in this study that can be used to predict the preferences of inhabitants (Dolan and White, 2007). The results indicate that the young yet heterogeneous area that is not too densely populated makes STEM workers happy. This suggests that policy-makers and planners concerned with the building environment should focus on the surroundings of the high-tech business park at stake. The geographical area around a high-tech

business park is attractive for STEM workers when it is characterized by a suburban lifestyle, green areas and open spaces including a little touch of consumer amenities. As such, policies should capture the human atmosphere contributing to social and economic processes which construct a particular spatial setting.

References

Boterman, W., & Bontje, M. (2016). 'The' creative class does not exist. Contrasting the residential preferences of creative and technical workers in Amsterdam and Eindhoven. In S. Musterd, M. Bontje, & J. (. Rouwendal, *Skills and cities: Implications of location preferences of highly educated workers for spatial development of metropolitan areas.* (pp. Part II - chapter 5 1-36). Oxon, New York: Routlegde.

Cameron, A., & Trivedi, P. (2009). *Microeconometrics using stata.* Texas: Stata Press.

Carnevale, A., Smith, N., & Melton, M. (2011). *STEM: Science Technology Engineering Mathematics.* Washington, DC: Georgetown University Center on Education and the Workforce.

Clark, A., Frijters, P., & Shields, M. (2006). Income and happiness: Evidence, explanations and economic implications. *PSE Working Papers n2006-324*, 1-64.

Clark, E., Westergård-Nielsen, N., & Kristensen, N. (2009). Economic satisfaction and income rank in small neighbourhoods. *Journal of the European Economic Association 7(2–3):519–527*, 519–527.

Clark, T., Lloyd, R., Wong, K., & Jain, P. (2002). Amenities drive urban growth. *Journal of Urban Affairs*, 493-515.

Dagevos, J. (2014). Maakt de buurt verschil? Bevolkingssamenstelling en interetnische verhoudingen. . In J. Bakens, H. de Groot, P. Mulder, & C.-J. (. Pen, *Soort zoekt soort. Clustering en sociaal-economische scheidslijnen in Nederland.* (pp. 83-93). Rotterdam: Platform31.

Dahl, M., & Sorensen, O. (2010). The migration of techincal workers. *Journal of Urban Economics*, 33-45.

Diener, E., & Seligman, E. (2004). Beyond money. Toward an economy of well-being. *Psychological Science in the Public Interest*, 1-31.

Diener, E., Oishi, S., & Lucas, R. (2003). Personality, culture, and subjective well-being: emotional and cognitive evaluations of life. *Annual Review of Psychology*, 403-425.

Dittmann, J., & Goebel, J. (2010). Your House, Your Car, Your Education: The Socioeconomic Situation of the Neighborhood and its Impact on Life Satisfaction in Germany. *Social Indicators Research*, 497–513 .

Dolan, P., & White, M. (2007). How can measures of subjective well-being be used to inform public policy? *Perspectives on Psychological Science*, 71-85.

Dolan, P., Peasgood, T., & White, M. (2008). Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being. *Journal of Economic Psychology*, 94-122.

Easterlin, R. (1974). Does economic growth improve the human lot? *Nations and households in economic growth*, 89-125.

Florida, R. (2002a). *The rise of the creative class.* New York: Basic Books.

Florida, R. (2002b). The economic geography of talent. *Annals of the Association of American Geographers*, 743-755.

Florida, R., & Gates, G. (2001). *Technology and Tolerance: The importance of diversity to high-technology growth.* Washington DC: Brookings Institution, Center for Urban and Metropolitan Policy.

Florida, R., Mellander, C., & Rentfrow, P. (2013). The happiness of cities. *Regional Studies*, 613-627.

Florida, R., Mellander, C., & Stolarick, K. (2011). Beautiful places: the role of perceived aesthetic beauty in community satisfaction. *Regional Studies*, 33-48.

Glaeser, E., Gottlieb, J., & Ziv, O. (2016). Unhappy cities. *Journal of Labor Economics*, 129-182.

Glaeser, E., Kolko, J., & Saiz, A. (2001). Consumer city. *Journal of Economic Geography*, 27-50.

Harsanyi, J. (1982). Morality and the theory of rational behaviour. In A. S. (Eds.), *Utilitarianism and beyond* (pp. 39-63). Cambridge: Cambridge University.

Helliwell, J., & Putnam, R. (2004). The social context of well-being. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 1435-1446.

Hooijen, I., & Cörvers, F. (2015). Het aantrekken van kenniswerkers in een krimpgebied. *Rooilijn*, 288-295.

Jeanett, J.-P., & Schreuder, H. (2015). *From coal to biotech. The transformation of DSM with business school support.* Berlin Heidelberg: Springer-Verlag.

Kahneman, D., Diener, E., & Schwarz, N. (1999). *Well-being: Foundations of hedonic psychology.* New York: Russell Sage.

Kahneman, D., Krueger, A., Schkade, D., Schwarz, N., & Stone, A. (2004). A Survey Method for Characterizing Daily Life experience: The Day Reconstruction Method. *SCIENCE*, 1776-1780.

Knies, G. (2011). Income comparisons among neighbours and satisfaction in East and West Germany. *Social Indicators Research*, 471–489.

Kotkin, J. (2000). *The new geography: How the digital revolution is reshaping the American landscape.* New York: Random House.

Künn-Nelen, A. (2016). Does commuting affect health? *Health Economics*, 984-1004.

Morrison, P. (2007). Subjective well-being and the city. *Social Policy Journal of New Zealand*, 74-103.

Morrison, P. (2010). Local expressions of subjective well-being: The New Zealand experience. *Regional Studies*, 1039–1058.

Musterd, S., Bontje, M., & Rouwendal, J. (2016). An introductory framework. In S. Musterd, M. Bontje, & J. (. Rouwendal, *Skills and cities: Implications of location preferences of highly educated workers for spatial development of metropolitan areas.* (pp. Part I, chapter 1, 1-19). New York: Routlegde.

Musterd, S., de Vos, S., Das, M., & Latten, J. (2011). Neighbourhood composition and economic prospects: a longitudinal study in the Netherlands. *Journal of Economic and Social Demography*, 85-100.

OECD. (2010). *OECD Economic Surveys: Netherlands, overview.* Paris: OECD Publishing.

OECD. (2013). *OECD Regions at a Glance 2013.* Paris: OECD Publishing.

OECD. (2014). *OECD Territorial Reviews: Netherlands 2014.* Paris: OECD Publishing.

Olsson, L., Gärling, T., Ettema, D., Friman, M., & Fujii, S. (2013). Happiness and Satisfaction with Work Commute. *Social Indicators Research*, 255-263.

Rijnks, R., Koster, S., & McCann, P. (2016). Spatial heterogeneity in amenity and labor market migration. *International Regional Science Review*, 1-47.

Romer, P. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 1002-1037.

Romer, P. (1990). Endogenous technological change. *Journal of Political Economy*, 71-102.

Scott, A. (2006). Creative cities: conceptual issues and policy questions. *Journal of Urban Affairs*, 1-17.

Scott, A. (2010). Jobs or amenities? Destination choices of migrant engineers in the USA. *Papers in Regional Science*, 43-63.

Shields, M., & Wheatley Price, S. (2005). Exploring the economic and social determinants of psychological well-being and perceived social support in England. *Journal of the Royal Statistical Society*, 513-537.

Shields, M., Wheatley Price, S., & Wooden, M. (2009). Life satisfaction and the economic and social characteristics of neighbourhoods. *Journal of Population Economics*, 421-443.

Shucksmith, M., Cameron, S., Merridew, T., & Pichler, F. (2009). Urban-rural differences in quality of life across the European Union. *Regional Studies*, 1275-1289.

Sjaastad, L. (1962). The costs and returns of human migration. *Journal of Political Economy*, 80-93.

Sleutjes, B. (2013). *The hard and soft side of European knowlegde regions. Higher educated location preferences (HELP-UVA VU).* Amsterdam: Universiteit van Amsterdam.

Sleutjes, B. (2015). Woonvoorkeuren van kennismigranten. *DEMOS*, 4-7.

Sørensen, J. F. (2014). Rural-Urban differences in life satisfaction: Evidence from the European Union. *Regional Studies*, 1451-1466.

Statistics, N. (2016). *Toelichting Wijk- en Buurtkaart 2014,2015 en 2016.* Den Haag/Heerlen: CBS.

Statistics, N. (2017, February 2). *Bevolking; kerncijfers*. Retrieved from Statline CBS: http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=37296NED&D1=14-18,28,68&D2=50,l&VW=T

Statistics, N. (2017, February 4). *Bevolkingsontwikkeling; levendgeborenen, overledenen en migratie per regio.* Retrieved from Statline CBS: http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=37259NED&D1=0,22-23&D2=0&D3=0,16,55&D4=40,l&VW=T

Statistics, N. (2017, February 2). *Regionale kerncijfers Nederland*. Retrieved from Statline CBS: http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=70072NED&D1=12-20,43,56&D2=5-16,53-55&D3=5,l&HDR=T&STB=G1,G2&VW=T

Stutzer, A., & Frey, B. (2008). Stress that doesn't pay: The commuting paradox. *The Scandinavian Journal of Economics*, 339-366.

Tiebout, C. (1956). A pure theory of local expenditures. *Journal of Political Economy*, 416-424.

Venhorst, V., van Dijk, J., & van Wissen, L. (2010). Do the best graduates leave the peripheral areas of The Netherlands? *Tijdschrift voor Economische en Sociale Geografie*, 521-537.

Appendix

Model 1 includes control variables only. The distance from home to work and from home to the nearest main road is estimated in model 2. Model 3 estimates the role of amenities on the life satisfaction. Model 4 assesses the role of different demographic factors of the municipality. In all models we included clusters for the different municipalities. From model 2 to 4 we use interaction effects between STEM workers and the independent variables.

Table 1 Ordinary least square (OLS) regression results on life satisfaction.

Life satisfaction	Model 1	Model 2	Model 3	Model 4
Control variables				
Age	0.0216	0.0349	0.0497	0.0531
	(0.0523)	(0.0557)	(0.0562)	(0.0519)
Age squared	-0.000195	-0.000333	-0.000493	-0.000527
	(0.000597)	(0.000635)	(0.000639)	(0.000589)
Gender (female)	0.278	0.261	0.262	0.253
	(0.270)	(0.286)	(0.304)	(0.304)
Partner (yes)	**0.262****	**0.233***	**0.228***	**0.251****
	(0.112)	(0.115)	(0.116)	(0.115)
Nationality (Dutch)	**0.411****	**0.309***	0.186	0.194
	(0.186)	(0.181)	(0.195)	(0.205)
Education medium (ref: low)	0.167	0.184	**0.189***	**0.205***
	(0.111)	(0.112)	(0.108)	(0.105)
Education high (ref: low)	0.262	0.348	**0.397***	0.405
	(0.199)	(0.222)	(0.233)	(0.244)
Children living at home (yes)	0.00938	0.00787	-0.0249	-0.0220
	(0.105)	(0.108)	(0.105)	(0.0982)
Monthly expenses dwelling	-0.0565	-0.0561	-0.0661	**-0.0648***
	(0.0416)	(0.0423)	(0.0416)	(0.0364)
Monthly gross income 2500€-4500€	0.0718	0.0654	0.0543	0.0377
	(0.218)	(0.223)	(0.226)	(0.217)
4500€-6500€	0.187	0.165	0.179	0.0984
	(0.194)	(0.203)	(0.204)	(0.193)
>6500€	**0.605****	**0.566****	**0.531****	**0.470****
	(0.223)	(0.224)	(0.235)	(0.224)
STEM worker	-0.0209	-0.0268	-0.0520	-0.00916
	(0.151)	(0.144)	(0.105)	(0.0993)
Distance from home to work		0.000144	-0.000420	0.000881
		(0.00372)	(0.00420)	(0.00525)
Distance from home to the nearest main road		-0.0445	-0.304	-0.266
		(0.193)	(0.314)	(0.349)
Number of businesses			1.74e-05	6.43e-06
			(3.06e-05)	(3.61e-05)
Number of restaurants and bars in a radius of km²			0.0350	0.0428
			(0.0237)	(0.0367)
Average annual income per inhabitant in a municipality				-0.0532
				(0.0585)
% of cultural diversity				-0.0237
				(0.0523)
% of people aged 65>				-0.0291
				(0.0693)

Population density				-1.92e-05
				(0.000163)
Interaction Distance				
STEM worker x distance		-0.00509	-0.00511	**-0.0123***
		(0.00622)	(0.00600)	(0.00617)
STEM worker x nearest main road		-0.208	0.270	-0.00574
		(0.263)	(0.337)	(0.358)
Interaction Amenities				
STEM worker x number of businesses			-1.43e-05	**-0.000146****
			(4.13e-05)	(6.31e-05)
STEM worker x number of restaurants and bars			**-0.101*****	**-0.0777***
			(0.0249)	(0.0420)
Interaction Demographics				
STEM worker x average annual income municipality				**0.454*****
				(0.145)
STEM worker x cultural diversity				**0.120****
				(0.0593)
STEM worker x ageing				**-0.219****
				(0.0910)
STEM worker x population density				-1.86e-05
				(0.000224)
Constant	**7.307*****	**7.126*****	**6.969*****	**6.899*****
	(1.116)	(1.146)	(1.185)	(1.136)
Observations	414	414	414	414
R-squared/Pseudo R2	0.061	0.068	0.084	0.113

Note: Coefficients are reported and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

We enter individual and their household characteristics as control variables only in model 1, the baseline model. It shows that having a partner, having the Dutch nationality and having a monthly gross income of 6500€ or more positively and significantly contributes to one's overall life satisfaction. Controlling for individual and household characteristics in model 2, we now find that also a higher educational level adds significantly up to one's overall life satisfaction. The coefficients of interactions between STEM workers and commuting distance and STEM workers and the distance from home to the main road are negative, yet not significant. Next, we add interactions between STEM workers and amenities in model 3. STEM workers become significantly less satisfied when the number of bars and restaurants increases (p<0.001) relative to non-STEM workers. Furthermore, in model 3, nationality loses significance, yet having a partner, a higher educational level and a monthly gross income of 6500€ or more still positively and significantly contribute to one's overall well-being. In model 4, the full model, we enter all independent variables and interact them with being a STEM worker. Having a partner, a higher educational level and having a monthly gross income of 6500€ still give the same result as control variables compared to previous models. In model 4 the control variable monthly expenses for the dwelling also becomes significant, yet negative. The statistical significant results of the full model show that STEM workers, relative to non-STEM workers become less satisfied if the commuting distance increases (p<0.05). Life satisfaction also decreases when the number of companies (p<0.01), bars and restaurants (p<0.01) within ones municipality increases relative to those not occupied in the STEM field. Relative to non- STEM, STEM workers become more

satisfied if the average income of the municipality they live in increases (p<0.001) correcting for individual income. The same is true for an increase in the share of a cultural diverse population (p<0.05). Lastly, STEM-workers show to become less satisfied if the share of people aged 65 and over increases (p<0.01) relative to non-STEM workers.