For the 57th ERSA Congress, August 2017, Groningen

Do urban amenities explain income sorting in cities?

Microgeography of endogenous amenities using geo-coded data for Stockholm metropolitan region

Özge Öner*

ozge.oner@ju.hj.se

Do urban amenities, such as consumer services, shops, and arts & entertainment facilities, explain income sorting within a city? Using unique geo-coded micro-data from Sweden for 2001-2013, I estimate the likelihood of moving across the neighborhoods of Stockholm metropolitan region for individuals with different income levels to determine with respect to various types of urban amenities at the neighborhood level. The analysis also takes into account centrality, and various individual factors that may relate to within-city mobility. In line with previous theories for endogenous amenities, I find that average income in the neighborhood is an amenity itself, and the availability of amenities –over and above the size of the neighborhood- implies a push-factor for the low-income individuals and a pull-factor for the high-income individuals. Further analysis signals that density disincentives individuals to move to moderate and high-amenity neighborhoods, as it indicates a crowding out effect, whereas it appears to be a pull-factor for the neighborhoods with no or very few amenities, potentially signaling a tradeoff between urban amenities and the availability of large housing units.

*Corresponding author, Research Fellow at the Research Institute of Industrial Economics, Stockholm & Jönköping International Business School, Jönköping – Sweden.

1. Introduction

The traditional way of viewing cities and regions only as hubs of production have been challenged by the more recent literature within the field of urban and regional economics, where the function of cities as consumption space is accentuated (Brueckner et al. 1999, Glaeser et al. 2001, Clark, 2003a). Man-made (endogenous) amenities are argued to act as an attractor, where firms and individuals are systematically sorted into amenity rich areas. An important aspect of amenities is its potential to determine the income distribution across the neighborhoods of a city. Such relationship is recognized in the literature, however empirical studies investigating income sorting with respect to amenities is fairly limited. Such limitation is due to two things that operate simultaneously. First, identification of urban amenities in geographically disaggregated areas is not always possible. When data is available at a high resolution such as neighborhood, neighborhood is not exogenously identifies. It is often that the definition of a neighborhood relies on an historical path dependency through which a cluster of economic activity and/or population is what makes up a neighborhood. Because of this, it is not easy to identify whether it is the amenities that attract an individual to move to a neighborhood, or if the amenities are altered after the people living there. The second factor is the lack of longitudinal data to identify the residential sorting patterns of an individual while accounting for her (i) characteristics, (ii) and place of work. Aggregating the attributes of a sub population in a delimited area tells us what kind of people are living in that environment. But it does not necessarily tell us whether they choose to be there for specific attributes of the place. One elegant way to do that is through the observation of individual residential mobility. In this paper, I aim at investigating within-city moving patterns of individuals with varying income with respect to urban amenities. To do so, I use geo-coded microdata for the Stockholm metropolitan area for 2000-2013 and a probabilistic empirical design to estimate the determinants of individuals' residential mobility, specifically the importance of urban amenities in exogenously assigned neighborhoods.

Amenities, in this context, can be broadly defined as place-specific assets that are known to contribute to a city's or neighborhood's attractiveness. They can be exogenous (e.g. natural amenities and historical assets) or endogenous (retail and consumer services) (see Brueckner et al. 1999). Their importance for regional growth and development is undeniable in today's urbanized world. Places with attractive assets are found to attract highly skilled individuals (Jacobs, 1961; Brueckner et al., 1999; Florida 2008). A concentration of amenities, arts and culture, is found to be relevant to population growth and development in both central and peripheral locations (Partridge et al., 2008; Mellander et al., 2011; Öner, 2017).

Despite the attention paid to the importance of amenities for land use and property prices, we see relatively little emphasis on its relevance for within city mobility of individuals. The scarcity of empirical research on within city mobility, in general, is due to a lack of sufficiently disaggregated geographical data on individuals moving patterns within city areas. The amenity-based theory of location by income suggests that rich should favor the amenity rich areas in the center of the city, where endogenous amenities are the product of the overall income level (Brueckner et al. 1999). In this scenario, cheaper housing possibilities in the suburb are offset by the consumption possibilities in the urban core –holding the commuting cost constant. The limitations of the empirical research on the relationship between amenities and income sorting is not only due to the problems with geographical aggregation. A careful consideration of urban-suburban dichotomy is likewise needed for analyzing such relationship. It may be the case that the housing opportunities in the suburbs of the city, where amenities are not abundant, can offset the benefits of living in an amenity rich area once commuting is accounted for, a phenomenon we see in many large and central cities. Previous studies on amenities (e.g. Brueckner et al., 1998) take a binary approach where they identify a core and a suburb from a theoretical perspective. However the urban form is not binary. There is a continuum of neighborhoods between what can be defined as the urban core and the periphery. The geo-coded data that is employed in the empirical analysis of this paper allows for calculating distances to the local and the urban central business districts separately in a continuous fashion, which means that the relevance of distance to core is not categorical. This feature of the data also allows for understanding a Christaller-type centrality and hierarchy (Christaller, 1933; Lösch, 1954).

The preliminary analysis suggests that average income in the neighborhood is an amenity itself, and the availability of amenities –over and above the size of the neighborhood- implies a push-factor for the low-income individuals and a pull-factor for the high-income individuals. Further analysis signals that density disincentives moving to moderate and high-amenity neighborhoods, as it indicates a crowding out effect, whereas it appears to be a pull-factor for the neighborhoods with no or very few amenities.

2. Urban amenities and spatial equilibrium

Spatial externalities are closely tied to the attractiveness of places, and their influence is reflected in their housing market. There are a number of attractive attributes for a city's future residents, such as the depth and breadth of consumer amenities, natural amenities, opportunities in the labor market, and cultural assets. When the combination of such factors pull a greater

degree of population to its borders, consequently, such increase in demand for residential space results in higher property prices (Riviera-Batiz, 1988; Brueckner et al., 1999; Nilsson, 2015). Some of these elements are intrinsic to a place and don't vary over time, whereas other elements relate to the size of the place in terms of population and total income as an indicator for purchasing power. Geographic proximity to these elements elevates the quality-of-life aspect of places. Cities in this context provide individuals with a capacity for social interaction through increased access to people, consumer amenities and other types of cultural and historical amenities.

Housing prices are primarily affected by proximity to urban nodes, where agglomerative forces provide individuals with benefits of externalities. For example, densely populated areas are shown to indicate a greater access to larger job markets, an urban wage premium, and a better labor market matching (Glaeser and Máre, 1994; Ciccone and Hall, 1996; Helsley and Strange, 1990; Andersson et al., 2013; Larsson, 2014, 2016). Not only jobs but also nearly all economic activities are distributed across space in a systematic manner. Location theories addressing the systematic variation in the spatial distribution of economic activities date back to von Thunen (1826). In his approach, transportation costs (depending on the distance to the central market) are proposed to be the main determinant of how economic activities with varying interaction intensity are distributed across space, which results in varying land prices. Theories of size and density for urban areas have been further developed by several location theorists following this essential idea (Weber, 1909; Christaller, 1933; Lösch, 1954; Isard, 1956; Beckmann, 1958; Alonso, 1964).

Proximity to the central marketplace and the economic density around it are important components of place attractiveness. However, density alone doesn't satisfy a significant degree of "place attractiveness". Some of the attractiveness relate to natural amenities such as open space, parks and green areas, urban forest, farmlands and water covers, which are found to contribute to the location premium that is reflected in housing prices (Cheshire and Sheppard, 1995; Tyrväinen and Miettinen, 2000; Irwin, 2002; Andersson and West, 2006; Gibbons et al., 2011; Nilsson, 2014). The earlier literature argues that the spatial heterogeneity in housing prices can—at least to some extent—be explained by these types of local 'open space amenities' (Geoghegan et al., 1997; Cho et al., 2008). However, most of the amenities that are not intrinsic to locations are the products of agglomerative forces and density in space. The agglomeration of private and public services (and goods) is acknowledged to be one of the most important determinants of the variation in housing prices across cities as well as across countries (Dubin and Sung, 1987; Andersson, 1997; Adair et al., 2000; Söderberg and Janssen, 2001; Andersson et al., 2010).

From the household and individual consumer perspective, there are several gains associated with agglomerative forces that also relate to the importance of urban amenities for place attractiveness. Rivera-Batiz (1988) notes that a greater variety of local goods and the consumption of traded goods have a substantial influence on household utility. The provision of public goods and services is also found to be subject to less friction in places with a high degree of localized spillovers (Artle, 1959; Andersson, 1985).

There are two spatial equilibrium approaches that deal with the importance of amenities for the spatial distribution of labor, thus income: within-city and across-city spatial equilibrium. One of the differences between within-city and across-city spatial equilibrium is that the wage levels are assumed to be constant in the first approach, whereas the later allows for wage differentials across cities. As wages relate to productivity, Glaeser (2008) notes that although productivity differences across space have a great influence on labor demand, for the sake of simplicity, labor demand can be considered exogenous rather than endogenous in the within-city spatial equilibrium. Whereas, in the Rosen-Roback framework for static spatial equilibrium across cities, housing prices are explained by wage levels and by the amenities that are present at a certain location (Rosen, 1979; Roback, 1982). Roback (1982) discusses how workers are distributed across locations with varying amenities and how this distribution is reflected in wages and housing prices. In this framework, holding the housing cost constant, we should see a lower wage level in response to high amenity, where the productivity of individuals is assumed constant (or in other words, the model is silent about the productivity returns to agglomeration). The analysis of amenities in such framework, however, is limited for understanding the role of amenities because it doesn't address the role of endogenous amenities and assigns the greater role to the natural amenities. Given that man-made amenities are produced through a concentration of income and secured by a critical mass of purchasing power, they should tightly be associated with the earnings of individuals in a location. Once the individual characteristics that underlie mobility of individuals are accounted for, we should see a positive relationship between the income of individuals and available endogenous amenities.

However, it is not only the people living in an area that patronizes the consumer amenities, but also the others that come from further parts of a city. This is discussed in detail by a large body of literature that deals with retail location (*for a review of the literature see Öner, 2014*). The arguments presented in this line of literature can be summarized as follows: Consumers' willingness to travel declines sharply by distance for goods that they consume more frequently (low-order goods), therefore such services would be scattered across space to a greater extent (Klaesson and Öner, 2014). Whereas for goods that they consume less-frequently or have a

greater preference for variety (high-order goods) their willingness to travel further distances increase. In fact, the way such pattern is discussed coincides in two parallel lines of literature, one dealing with multipurpose shopping, the other dealing with the "love-of-variety" effect -as in the NEG (New Economic Geography). The later type of consumer trips dictate the clustering of services in the urban center (Haynes and Fotheringham, 1984; Fotheringham and O'Kelly, 1989; Cadwalleder, 1996; Öner, 2016), and proximity to such clustering relates to the property prices as an indicator of place attractiveness (Öner, 2017).

There is indirect mechanism through which services may relate to place attractiveness too. Their presence secures a steady flow of people that secures a critical mass of people. Individuals do not derive utility only by patronizing the services themselves but by being in close proximity to them, which arguably gives them a quasi-public good status. In the Tiebout (1956) type of framework, rational individuals are expected to leave places with less attractive local public goods and move to places with more attractive local public goods. In his argument, individuals 'vote with their feet' by migrating to places with more attractive attributes associated with local public goods. For goods to be defined as pure public goods, such goods should be consumed without rivalry or exclusion. However, in the case of shops, distance (accessibility) serves as an exclusionary force because a consumer needs to be located within a certain proximity to enjoy the presence of a shop or service, either directly by consumption, or indirectly via its contributions above to place attractiveness.

3. Data, Variables and Empirical Strategy

3.1. Data

The data set employed in this study was extracted from a publicly audited, matched employer–employee database for 2001-2013 maintained by Statistics Sweden. The selection of the years is based on stability in the coding of the geographical information, as well as the industry categorization over time. The original database contains information on each workplace, firm, and individual in Sweden. Each workplace is associated with a pair of coordinates within a grid covering all of the city areas in Sweden. The size of the grids used in the study is 1000 by 1000 meters (approximately 0.6 by 0.6 miles). These grids do not follow any predetermined administrative boundary or historical definition, but rather constitute exogenously assigned neighborhoods in the empirical framework. They are small enough to correspond to a neighborhood, and large enough to contain a diversity of establishments and residents

simultaneously. Each workplace and the residence are pinned down to a location within the grids, and information on the establishment and its employees are then matched to each location. So the data allows me to calculate the exact distance between the residence and work place of any given individual in the labor market. Because all of the squares are the same size, there is no need to normalize the variables. For example, any difference in the number of individuals between any two squares is the exact difference in population density between those squares. In addition to simplifying the interpretation, the construction of the data eliminates problems with administratively defined geographical areas, which are often a hazard in spatial econometrics (cf. Openshaw & Taylor, 1979). The fact that Sweden is heavily regulated regarding building height also mitigates potential problems that may arise due to the variation in the availability of space for residence (e.g. overpopulation due to high-rise establishments). By introducing distance to CBD measures, regulatory differences in building height are controlled for.

The two maps below represent the average income and total amenities across 1000 square meter grids within the Stockholm metro area. Stockholm metropolitan area is determined based on the definitions of functional areas by Statistics Sweden. Functional local labor markets contain municipalities that can be nested under one region based on the intensity of commuting between them. The Stockholm metro area hosts a total of 30 municipalities.

The first map in the figure displays the distribution of income of the residents -in terms of averages wages- per 1000 square meter grids while the second map shows the total urban amenities –the number of establishments- in the same areas. The squares are colored with respect to the income and amenity levels in quintiles respectively, so they are comparable. Red color indicates high-income level and high amenity, followed by yellow and blue shades. The central business district of Stockholm is marked with a *star* in black on both maps. The data used for the maps is from 2013, which is the latest year used in the analysis.

At the first glance, we see a higher concentration of amenities in space compared to income. The neighborhoods that are populated by high-income individuals, but not high amenity areas, are those that offer large housing possibilities, whereas the city center is entirely populated by apartment buildings. While we see a clustering of amenities mostly in the urban core, we see a dichotomous distribution of high income between the urban core and certain suburban spots.

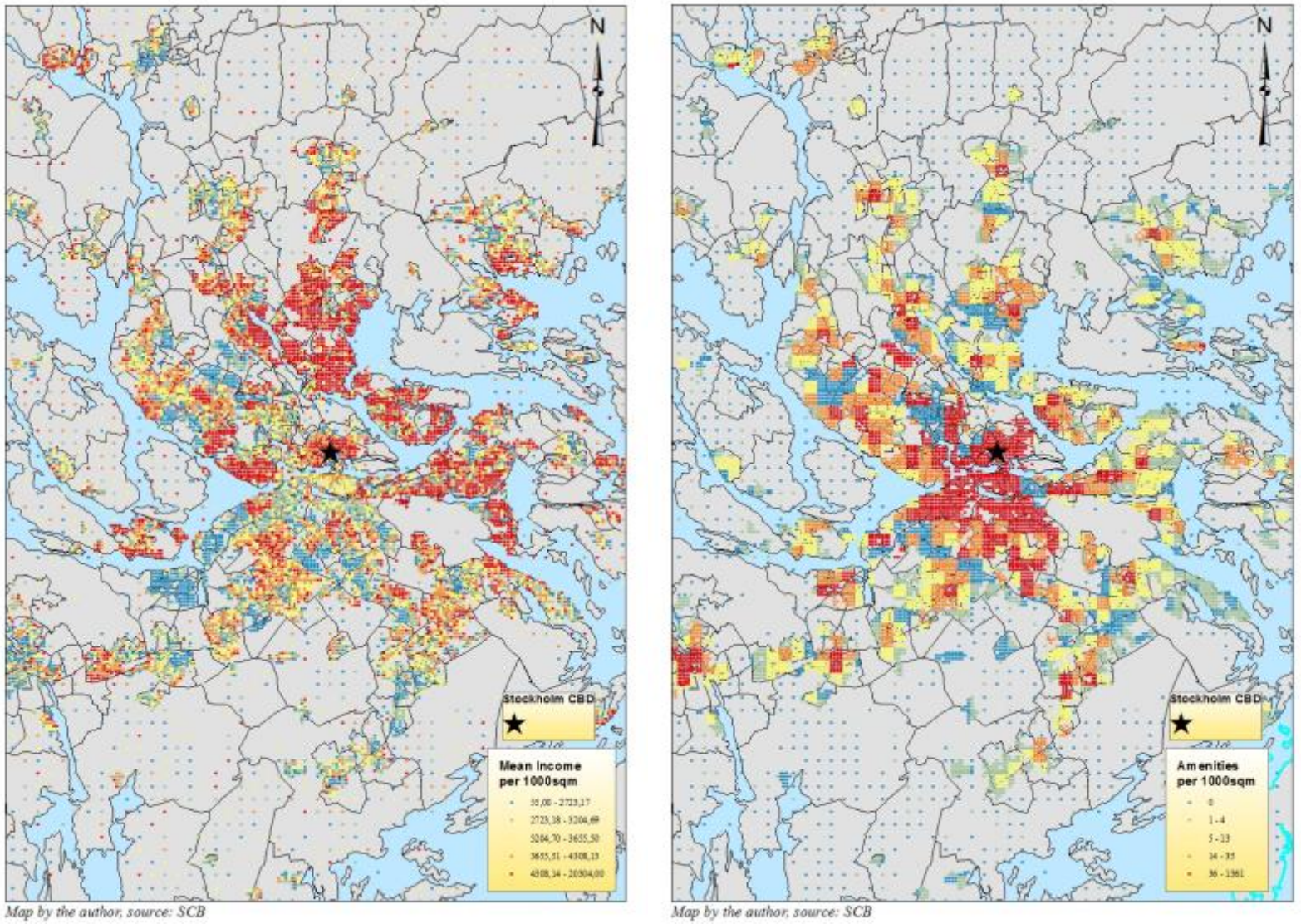

Figure-1: Average income (1) and total amenities in 1000 by 1000 square meter grids (2) in Stockholm metro area, 2013 ***(map by author, source: Statistics Sweden)***

In the theoretical model for endogenous amenities presented in Brueckner et al. (1998), it is argued that the amenities and wage (representing purchasing power in a particular area) can interchangeably be used since amenities is determined by the wage level in an area. The level of aggregation is crucial to understand whether such relationship holds or not. By way of mapping and looking into the pairwise correlation between average wage and the total number of amenities at the neighborhood level, I display that that the relationship between the two is not necessarily very strong. They are dependent on each other, but not mutually exclusive once such relationship is examined at a more disaggregated level than previous studies employ in their analysis, e.*g. core and suburb*. Such empirical regularity makes it a particularly interesting case to compare different neighborhoods' pull effect for individuals with varying characteristics that are controlled for.

3.2. Variables

Variables used in the analysis is presented in Table-1 below. Definitions are presented alongside the motivation to integrate them into the specification. Descriptive statistics is available in the appendix.

Table-1: Variables and their definitions

Individual level variables	
Income	Income of the individual in a given year. This variable is log transformed. Individuals with no income are excluded from the analysis.
Age	Age of the individual (log transformed).
Male	A dummy variable that takes the value 1 if the individual is male 1, 0 if female.
Cohabitation	This dummy xsvariable is to identify those individuals that are cohabiting with a spouse or a life partner. If it is not a single household it is 1, otherwise 0.

Child below 18	If there is, at least, one child below the age 18 living in the household the variable is 1, otherwise 0.
High human capital	If the individual has three or more years of higher education the dummy variable is 1, otherwise 0.
Immigrant dummy	If the individual immigrated into Sweden at any point in time the variable is 1, otherwise 0. This to a large extent captures the foreign-born population, with exceptions where a Swedish citizen may have migrated into the country.
Job change in t-1	This is a dummy variable to identify the likelihood of moving if an individual changed job the year before.
Occupational classification: ***Creative job*** **and** ***Service job***	A dummy variable is introduced with respect to the type of occupation the individual holds. Creative class taxonomy used for such classification (see Florida, 2002).
Spatial variables (1000sqm) and Distance variables	
Neighborhood population 1000sqm	This variable is logged transformed population at the n neighborhood level. Since the squares are of the same physical size, the variable also represents population density. It is used to control for size in the orthagonalization of the amenity variable, as well as to see the effect of density for the likelihood to move in the second set of specifications.
Distance to work in t-1	This variable is a log-transformed distance variable that identifies the distance between the location an individual lived and the location where he/she works in terms of 1000 square meter grids the year before he/she moves if she does so. It is to capture how commuting cost come into play when deciding to move or not.
Distance to Stockholm CBD	This variable is a log-transformed distance variable that measures the distance between the location moved and the central business district of the Stockholm metro area. The CBD is defined by identifying the 250 square meter grid that hosts the highest number

	of different industries. Although the empirical application allows the exact location of CBD vary over time, it is stable over the period of the study, signaling strong path dependence. Same CBD is used throughout the analysis for every year since the spatial variation is insignificant.
Distance to local CBD	This variable is a log-transformed distance variable that measures the distance between the location moved and the central business district in the local municipality. As mentioned previously the metro area is constituted by 30 municipalities. A square, while being in the metro area, may not be in the Stockholm central municipality. In that case, there will be a local center. By having the two distance to CBD variables, we control for Christaller type hierarchy for the effects of centrality on hierarchical order in a continuous way.
Share of singles in the neighborhood (1000x1000)	The share of individuals living in the neighborhood where individual moves to. This control variable proxies for life style and marriage market effects.
Share of gay (1000x1000)	To proxy for the openness and tolerance, a variable that identifies the share of the gays in the neighborhood that are in civil partnership or homosexual marriage is introduced.
Human capital share in the neighborhood (1000x1000)	The share of individual in the neighborhood –in terms of 1000 square meter grids- that has three years or more in higher-education. The share of human capital in itself is expected to present a pull effect, as their appreciation for amenities –holding the income constant- is discussed to be higher than their counterparts in the literature.
Average age in the neighborhood	Average age in the 1000 square meter neighborhood, to proxy for the life style choices.
Immigrant share in the neighborhood (1000x1000)	The share of the immigrant population in the neighborhood within 1000 by 1000 square meter an individual moves to.

School, religion, sports, and health	These variables are to control for the possible pull effect that can be imposed on the individuals' decision by the availability of a school (operating below high-education level), a religious establishment, a sports venue or a health care establishment.
Amenity variables (1000sqm)	
Total amenity in 1000 square meter grids	These variables are the sum of shops, restaurants, bars, hotels, and arts and entertainment facilities for the two different aggregation of the neighborhood. A detailed list of urban amenities that are taken into account for the calculation of the total amenity variable is listed in table-2 below. Such variable, being endogenously determined by neighborhood population and total income in close proximity to a large extent, correlates with any size variable (i.e., population or total income). The variable therefore should be interpreted as a sheer size measure. It is logged transformed.
Excess amenity in 1000 square meter grids	This variable are orthogonalized against the total number of people living in the neighborhood. Orthogonalization[1] is done by the way of saving the residuals of an ordinary least squares estimation where the dependent variable is the total amenities, and the independent variable is the size of the neighborhood in terms of population. Since the areas are identical, it also means adjusting for population density. They should be interpreted as "excess amenities" since they are size adjusted. It, therefore, measures amenities available in a neighborhood over and above what one would expect given the size of it.

[1] Application of the orthogonalization approach can also be found in the works of Kim Karlsson (2012) and Hacker et al. (2014).

Table-2 summarizes the types of urban and other endogenous amenities that are taken into account while looking into the relationship between individuals move and spatial milieu.

Table-2: Amenities summarized

(i) Urban Amenities		(ii) Other (endogenous) Amenities
Department stores	Art	
Food stores	Second hand	Religious establishment
Alcohol monopoly	Restaurant	Sport venues (except gyms)
Pharmacy	Entertainment	Health
Special	Library&Museum	School
Clothing	Consumer Service	
Highorder retail	Beauty&Wellbeing	

3.3. Empirical strategy

The empirical analysis follows a probabilistic framework using individual level data. The likelihood of an individual moving to a different neighborhood within the Stockholm metro area with respect to a set of individual and spatial variables are estimated via logit regressions. Although most of the dependent variables are zero, as only approximately 10 percent of the individuals move within the city in a given year, there is no reason to think one or few of our variables are the factors that can be used to distinguish "true zeros" from the others. Moving rate does not differ significantly across income groups. The estimated logit model can be defined as:

$$\Pr(E_{i,t}|\mathbf{X}) = 1/(1 + exp[-(\theta(X'\Gamma))]) \quad (1)$$

$$X'\Gamma = \alpha + I'_{i,t} + D'_{i,t} + Z'_{j,t-1} + \varepsilon_{i,t} \quad (2)$$

Where $E_{i,t}$ is a binary outcome variable indicating whether an individual *moved* from one part of the metropolitan area to another (location noted with *i*) between *t* and *t-1*. The location is defined in 1000 square meter grids. A vector of variables $I'_{i,t}$ for the period t with respect to the location moved (*i*) as well as the individual characteristics in the same period are introduced to the specification. $D'_{i,t}$ represents a vector of distance variables to identify the hierarchical position of the neighborhood in period t by the use of as crow flies distance to Stockholm CBD (Central Business District), as well as to the local CBD in the respective municipality. In addition to the

two distance to CBD variables, a commuting distance (absolute distance between residence and work place) for period t-1 is incorporated into analysis to capture the transportation cost prior to move. $Z'_{j,t-1}$ represents a vector of variables for the period t-1 that identify the location the individual resided in the period before the move (noted with *j*).

Two sets of logit estimations are performed for the likelihood of an individual moving within the city to ask the following:

1. *What is the likelihood of moving to another neighborhood with respect to individual and place specific variables across* ***different income groups****?*

   Three income groups are identified to answer this question: **High-income, Middle income, and Low income** using percentiles. The goal is to see whether the likelihood of moving with respect to amenities in general, and *excess amenities* in particular, varies across these three different income groups. Do high-income individuals respond to the availability of amenities differently compared to their counterparts at the other end of the income distribution holding everything else constant?

Development of yearly income per income group over the period 2000-2013 can be seen in Table-3. As the figures indicate, the development seems similar for each group, where one group doesn't increase in percentages significantly more than other.

Table-3: Development of income across income groups, 2000-2013

	2000	2013	Monthly wage 2000*	Monthly wage 2013*	Change 2000-2013
Low	75000	110000	6,250 kr	9,167 kr	0.47 kr
Middle	207000	307000	17,250 kr	25,583 kr	0.48 kr
High	390000	570000	32,500 kr	47,500 kr	0.46 kr

**Averages based on yearly wage*

2. *What is the likelihood of moving into neighborhoods with varying scale of amenities with respect to an individuals' income?*

   Here the goal is to capture the direct relationship between income and likelihood of being sorted into a high amenity area, holding all else constant. In order to understand if such sorting takes place, I categorically define potential locations to move with respect to the number of amenities available: **No Amenity, Poor amenity, Moderate Amenity**, and **High Amenity neighborhoods**.

Table-4 displays the total number of squares with respect to the number of people living in these square over the period 2000-2013. The figures indicate that there is an overall decline in

the number of squares with poor, moderate and rich amenity, while the number of squares where there is no amenity grew by 10 percent. This is fairly interesting given that the total number of amenities in Stockholm metro region increased over the same period, which means the amenities in 2013 are more spatially concentrated than the year 2000. It is the mirror image when we look at how the population in these squares have developed over the same period. The average number of people living in neighborhoods with poor, moderate and rich amenity have increased while it decreased by about 10 percent in no amenity neighborhoods.

Table-4: Development of population per neighborhood type defined in terms of amenities, 2000-2013

	No Amenity	**Poor Amenity**	**Moderate Amenity**	**Rich Amenity**
	2000	**2000**	**2000**	**2000**
Number of sq	6973	756	463	209
Average population	27	119	725	2266
Change (2000-2013) Number of sq	0,10	-0,61	-0,31	-0,57
Change (2000-2013) Average population	-0,11	0,55	0,34	0,05

4. Results: Microgeography of urban amenities

On table-5, we see the first set of logit estimations with the individual level variables and neighborhood level variables. The variable of interest is the orthogonalized amenity variable: *Excess Amenity*. Age for all income groups is associated with less likelihood of moving. Male individuals in the low-income group are more likely to move compared to their female counterparts, whereas the opposite is evident for middle and high-income groups. Human capital is associated with higher likelihood of moving for the individuals in the low and middle-income groups, but not for those that are in the high-income group. This result, similar to age, possibly signals a more long-term settlement for those that have a higher purchasing power. Being immigrant is associated with an increased likelihood of moving for the individuals in all income groups where the size of the coefficients does not vary significantly across these groups. Cohabiting with another individual (a spouse or a partner) is associated with less likelihood to move. Such relationship is particularly strong for those that are in the low-income group. Having a child below the age 18 in the household is associated with less likelihood of moving for the individuals in the low-income group, and a positive likelihood of moving for those that are in the middle and high-income groups. Changing job the year before the move is associated with a higher likelihood of moving where the size of such relationship is smaller for the high-income individuals compared to the other two groups.

Distance to work the year before is associated positively with the likelihood of moving for all income groups. Long commuting distance seems to be a push-factor for individuals' decision to move. This effect is significantly stronger for low-income group, commuting distance of whom are longer than the other two groups on average. Distance to local CBD has a positive effect on the likelihood of moving for the individuals in the low and middle-income groups, whereas such relationship is not significant for the high-income individuals. This result is in line with the hypothesis presented in the theoretical model for endogenous amenity (i.e. Brueckner et al, 1998) that high-income individuals may choose to sort themselves to the suburb if the housing opportunities offset the commuting cost.

A striking result is revealed when we look at the relationship between distance to Stockholm CBD from a neighborhood and the likelihood to move to that neighborhood. It is positive for the low-income individuals and negative for the middle and high-income individuals, signaling once again an urban-suburban dichotomy for the income groups in question.

Results for the amenity variables, being the variables of interest, present us with an interesting story line. Higher income level in a neighborhood appears to be an amenity on its own, such effect being much smaller for the low-income group compared to the other two. This kind of effect is discussed in the theory as a case for multiple equilibria where high-income earners may value income amenity more than the poor, resulting rich living either in the center or in the suburbs. Total stock of amenities in a neighborhood, as expected, has a negative association with the likelihood of moving to that neighborhood across all three income groups, as a higher density of economic activities implies higher property prices (omitted variable in the analysis proxied by population and move rate), which naturally indicates a lower likelihood to move to the location in question. The results, however, deliver what is hypothesized with the excess amenity variable. Excess amenity variable stands for amenities that are orthogonalized against the population in the respective neighborhood aggregations. The coefficients obtained for excess amenity, therefore, should be interpreted as a higher/lower likelihood of moving to a location with respect to amenities found in that location over and above what one expect from the size of the neighborhood in terms of population. Excess amenity in a neighborhood appears to impose a push-factor for the individuals in the low-income group, and a pull-factor for those in the high-income group, whereas we see no significant relationship for the middle-income individuals. Controlling for size (population density), we see that a surplus of amenities do indeed pull high-income individuals.

Table-2: **Logit estimations for the likelihood to move with respect to amenities,** ***2001-2013, 1000sqm***

	(1)	(2)	(3)
VARIABLES	Low Income	Middle Income	High Income
Individual variables			
Age *(ln)*	-0.0464***	-0.0608***	-0.0615***
	(0.000237)	(0.000201)	(0.000244)
Male *(dummy)*	0.0964***	-0.0245***	-0.0317***
	(0.00502)	(0.00419)	(0.00455)
Human Capital *(dummy)*	0.0955***	0.0651***	-0.0383***
	(0.00752)	(0.00544)	(0.00461)
Immigrant *(dummy)*	0.214***	0.287***	0.248***
	(0.00532)	(0.00466)	(0.00532)
Cohabitation *(dummy)*	-1.163***	-0.667***	-0.393***
	(0.00711)	(0.00607)	(0.00657)
Child below 18 *(dummy)*	0.347***	-0.0237***	-0.323***
	(0.00744)	(0.00647)	(0.00670)
Job change *t-1*	0.222***	0.184***	0.133***
	(0.00508)	(0.00466)	(0.00532)
Creative job dummy	0.0462***	0.0570***	0.120***
	(0.00866)	(0.00613)	(0.00811)
Service job dummy	0.0305***	0.0616***	0.186***
	(0.00759)	(0.00577)	(0.0100)
Distance variables			
Distance to work, *t-1 (ln)*	**0.105*** **	**0.0939*** **	**0.0426*** **
	(0.00168)	(0.00158)	(0.00185)
Distance to local CBD *(ln)*	**0.0111*** **	**0.0149*** **	**-0.00191**
	(0.00260)	(0.00221)	(0.00272)
Distance to Stockholm CBD *(ln)*	**0.00961*** **	**-0.0141*** **	**-0.0217*** **
	(0.00315)	(0.00281)	(0.00335)
Spatial variables			
Average income 1000sqm (ln)	**0.0761*** **	**0.270*** **	**0.228*** **
	(0.0111)	**(0.0102)**	**(0.0122)**
Excess Amenity 1000sqm (1000sqm_ln)	**-0.0195*** **	**0.0138**	**0.0215*** **
	(0.00463)	**(0.00334)**	**(0.00386)**
Total amenity in neighborhood *(1000sqm_ln)*	**-0.0178*** **	**-0.0270*** **	**-0.0301*** **
	(0.00295)	**(0.00254)**	**(0.00288)**
Human capital share *(1000sqm)*	-13.74***	-2.093	-3.351
	(3.268)	(1.800)	(2.135)
Share of gay *(1000sqm)*	-47.39	31.55	-25.01
	(70.77)	(20.50)	(52.55)
Average age *(ln) (1000sqm)*	0.0557***	0.0580***	0.0781***

	(0.00151)	(0.00138)	(0.00156)
Share of single *(1000sqm)*	-7.175***	-5.588***	-8.904***
	(1.197)	(0.757)	(1.362)
Immigrant share *(1000sqm)*	-0.0790	-4.435**	-3.088
	(2.094)	(2.078)	(2.864)
Rate of move in neighborhood *(1000sqm)*	8.655***	8.777***	9.919***
	(0.0776)	(0.0640)	(0.0637)
School *(1000sqm)*	-6.95e-05	0.000128	0.000472*
	(0.000302)	(0.000258)	(0.000252)
Religious establishment *(1000sqm)*	0.00110	0.00387***	0.0109***
	(0.00164)	(0.00148)	(0.00141)
Health service *(1000sqm)*	-0.000569***	-0.000543***	-0.00105***
	(0.000201)	(0.000175)	(0.000166)
Sports venue *(1000sqm)*	-0.00242**	-0.00138	-0.00189**
	(0.00105)	(0.000920)	(0.000930)
Year Dummies	Yes	Yes	Yes
Constant	-5.057***	-5.735***	-5.661***
	(0.102)	(0.0954)	(0.116)
Observations	2,197,658	3,636,432	3,720,780
Pseudo R2	0.0848	0.102	0.0861

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

The second step of the analyses looks into the specific relationship between income and amenity by identifying neighborhoods in terms of stock of amenities. Here I investigate whether income has a direct implication for sorting of the individual to locations with varying level of amenities, which then enables me to isolate the effect of size. Each estimation is a logit regression with year fixed effects for the likelihood of an individual to move to a (i) no-amenity, (ii) poor-amenity, (iii) moderate-amenity, and (iv) rich-amenity neighborhood. For the sake of simplicity, results for the other variables are not presented here, but they are available in appendix-2. Holding the other variables constant, individuals in the middle-income group are more likely, and high-income individuals are less likely to move to any of the four types of neighborhoods.

Since now I characterize the neighborhoods with respect to the stock of amenities, I can introduce a true size measure, which is the population in the neighborhood (1000 square meter). The decreasing likelihood to move to a square with respect to size is in line with the negative sign we found in the previous estimations for the stock of amenities. However, this result holds only for moderate amenity and rich amenity neighborhoods. In fact, population density as a good proxy for size indicates a positive association with the likelihood of moving to a no-amenity or

poor-amenity neighborhood –holding all else equal. Density appears to work as an exclusionary factor for neighborhoods with a certain scale of amenity stock, also implies higher demand and higher property prices that are omitted in the analysis. While density indicates a crowding out effect for the moderate and rich amenity neighborhoods, it appears to be an attractive attribute for the neighborhoods with no or very few amenities.

Table-6: The relationship between stock of amenities in a neighborhood (1000sqm grids) and likelihood to move, *2001-2013*. (Base category: *Low Income*)

	(1)	(2)	(3)	(4)
	No	***Poor***	***Moderate***	***Rich***
VARIABLES	Amenity	Amenity	Amenity	Amenity
Middle Income	**0.0494*** **	**0.0586*** **	**0.0240*** **	**0.00841** **
	(0.0135)	(0.0128)	(0.00592)	(0.00376)
High Income	**-0.0351** **	**-0.0501*** **	**-0.100*** **	**-0.0674*** **
	(0.0165)	(0.0152)	(0.00725)	(0.00456)
Neighborhood population (density)_*ln* (1000sqm)	**0.0837*** **	**0.0243*** **	**-0.0247*** **	**-0.0191*** **
	(0.00702)	(0.00696)	(0.00545)	(0.00417)
Observations	593,317	695,413	3,118,320	5,741,137
Pseudo R2	0.200	0.140	0.107	0.0829

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

As an additional step of analysis, I break down urban amenities to its categories and run individual regressions to display how they attract/repel different income groups to the respective neighborhoods where they are found. For the sake of convenience, I report only the sign of the coefficients. All other reported variables are held constant in these regressions. The effect of amenities (except movie theatres and specialized stores where it is statistically insignificant) is always positive. The size of the coefficients are statistically significantly different from one another, and systematically larger for middle income individuals than they are for low income individuals, and much higher for high income individuals that the other two.

Table-7: Strength of attractiveness by amenity types across income groups, *summary*

	Low Income	Middle Income	High Income
Consumer Services	+	+	+
Movie	0	+	+
Department Stores	+	+	+

Specialized	0	+	+
Food	+	+	+
Art	+	+	+
Restaurant	+	+	+
Alcohol	+	+	+

5. Concluding remarks

The results indicate an urban-suburban dichotomy for the income groups, where the high-income group is sorted either into areas with virtually no amenity or areas with an abundance of amenity. Poor amenity neighborhoods are where large dwellings and a large cluster of high-income individuals are found, and they are often located on the outskirts of the city (see the red clusters in the peripheral Stockholm in Figure-1). Whereas high amenity neighborhoods are located in the urban core, and likewise likely to be demanded by high income earning individuals.

The preliminary analysis in this paper signals high-income sorting into high amenity but low-density areas. Further investigation is needed to identify such distribution at varying distances from the urban core to address the urban sprawl. I also acknowledge that to understand the size of the effect originating from the availability of amenities on sorting, housing prices must be considered even tho such effect is controlled for by the use of proxies in ym empirical design. In addition, I find a positive effect for individual amenity types except a few cases for low income group in terms of their pull to a neighborhood. Such effect is systematically higher for high-income individuals. However, what specific composition of such amenities create the optimum attraction is not addressed in this paper, and a potential area for an empirical study. After all, it is not only the depth and also the breadth of the services that create the urban milieu, and I acknowledge that diversity should play a role in the process, about which the paper is silent for the sake of coherence.

Policy implications of such study is multifaceted. A large body of literature that investigates ethnic/cultural segregation to income segregation. The link between the discrete choice to move and urban amenities is an interesting and quite important aspect of such segregation patterns. Once we identify in what way certain parts of the city is attractive for different income groups, holding the housing prices constant, policies that deal with within-city geography of services can be used to mitigate systematic segregation patterns. Such policies can involve deregulations

related to zoning, or incentivizing the establishment of services in parts of the city that are not the historical service clusters.

References

ADAIR, A., MCGREAL, S., SMYTH, A., COOPER, J. and RYLEY, T. (2000) House prices and accessibility: The testing of relationships within the Belfast urban area, *Housing studies* **15**, 699-716.

ALONSO, W. (1964) *Location and land use. Toward a general theory of land rent,* Harvard University Press, Cambridge, MA.

ANDERSON, S. T. and WEST, S. E. (2006) Open space, residential property values, and spatial context, *Regional Science and Urban Economics* **36**, 773-789.

ANDERSSON, Å. E. (1985) *Creativity–The Future of Metropolitan Regions*, Prisma*,* Stockholm.

ANDERSSON, Å. E. and ANDERSSON D. E. (2006) *The economics of experiences, the arts and entertainment*, Edward Elgar Publishing, Cheltenham.

ANDERSSON, D. E. (1997) *Hedonic prices and center accessibility: conceptual foundations and an empirical hedonic study of the market for condominium housing in Singapore*, Doctoral dissertation, KTH

ANDERSSON, D. E., SHYR, O. F. and FU, J. (2010) Does high-speed rail accessibility influence residential property prices? Hedonic estimates from southern Taiwan. *Journal of Transport Geography* **18**, 166-174.

ANDERSSON, M., KLAESSON, J. and LARSSON, J. P. (2013) The sources of the urban wage premium by worker skills: Spatial sorting or agglomeration economies?, *Papers in Regional Science*.

ARTLE, R. (1959) Studies in the structure of the Stockholm economy, Business research Institute at the Stockholm School of Economics, Stockholm.

BECKMANN, M. J. (1958) City hierarchies and the distribution of city size, *Economic Development and Cultural Change* **6**, 243-248.

BRUECKNER, J. K., THISSE, J. F. and ZENOU, Y. (1999) Why is central Paris rich and downtown Detroit poor? An amenity-based theory, *European Economic Review* **43**, 91-107.

CADWALLADER, Martin T. (1996) Urban Geography: An Analytical Approach. Prentice Hall: Upper

Saddle River, New Jersey.

CHESHIRE, P. and SHEPPARD, S. (1995) On the price of land and the value of amenities, *Economica* **62**, 247-267.

CHO, S. H., POUDYAL, N. C. and ROBERTS, R. K. (2008) Spatial analysis of the amenity value of green open space, *Ecological Economics* **66**, 403-416.

CHRISTALLER, W. (1933) *Die zentralen Orte in Süddeutschland*, translated by Carlisle W. Baskin, 1966, as Central Places in Southern Germany, Prentice Hall.

CICCONE, A. and HALL, R. E. (1996) *Productivity and the density of economic activity*, No. w4313, National Bureau of Economic Research.

CLARK, T. N. (2003a) The City as an Entertainment Machine, Research in Urban Policy, 9.

CLARK, T. N. (2003b) 3. Urban Amenities: Lakes, opera, and juice bars: Do they drive development?, *Research in Urban Policy* **9**, 103-140.

CLARK, T. N., LLOYD, R., WONG, K. K. and JAIN, P. (2002) Amenities drive urban growth, *Journal of urban affairs* **24**, 493-515.

DES ROSIERS, F., THÉRIAULT, M. and VILLENEUVE, P. Y. (2000) Sorting out access and neighbourhood factors in hedonic price modelling, *Journal of Property Investment & Finance* **18**, 291-315.

DUBIN, R. A. and SUNG, C. H. (1987) Spatial variation in the price of housing: rent gradients in non-monocentric cities, *Urban Studies* **24**, 193-204.

FLORIDA, R. (2002). The rise of the creative class, and how it is transforming work, leisure, community and everyday life.

FLORIDA, R. (2008) *Who is your city? How the creative economy is making where to live the most important decision of your life,* Basic Books, New York.

FOTHERINGHAM, Stewart A. and Morton E. O'KELLY. (1989) Spatial Interaction Models: Formulations and Applications. Kluwer Academic: Dordrecht.

GEOGHEGAN, J., WAINGER, L. A. and BOCKSTAEL, N. E. (1997) Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS, *Ecological economics* **23**, 251-264.

GIBBONS, S., MOURATO, S. and RESENDE, G. (2011) The amenity value of English nature: a hedonic price approach, *SERC discussion paper 74,* Spatial Economics Research Center.

GLAESER, E. L. (2008) *Cities, agglomeration, and spatial equilibrium*, Oxford University Press, New York.

GLAESER, E. L. and MARE, D. C. (1994) *Cities and skills,* No. w4728, National Bureau of Economic Research.

GLAESER, E. L., GYOURKO, J. and SAKS, R. (2005) *Why have housing prices gone up?,* No. w11129. National Bureau of Economic Research.

GRAVES, P. E. and LINNEMAN, P. D. (1979) Household migration: Theoretical and empirical results, *Journal of urban economics* **6**, 383-404.

HAYNES, Kingsley E. and Stewart A. FOTHERINGHAM. (1984) Gravity and Spatial Interaction

Models Vol. 2. Sage Publications: Beverly Hills, California.

HELSLEY, R. W. and STRANGE, W. C. (1990) Matching and agglomeration economies in a system of cities, *Regional Science and Urban Economics* **20**, 189-212.

IRWIN, E. G. (2002) The effects of open space on residential property values, *Land economics*, **78**, 465-480.

ISARD, W. (1956) *Location and space-economy*, MIT Press, Cambridge, MA.

JACOBS, J. (1961) *The death and life of great American cities*, Random House, New York.

LARSSON, J. P. (2014) The Neighborhood or the Region? Reassessing the density-wage relationship using geocoded data, *Annals of Regional Science (forthcoming).*

LÖSCH, A. (1940) *Die räumliche Ordnung der Wirtschaft*, Jena, G. Fischer, English translation (1954): The Economics of Location.

MELLANDER, C., PETTERSSON, L. and ÖNER, Ö. (2011) Culture city, *Journal of Town and City Management* **2**, 246-262.

NILSSON, P. (2014). Natural amenities in urban space–A geographically weighted regression approach. Landscape and Urban Planning, 121, 45-54.

NILSSON, P. (2015). The influence of urban and natural amenities on second home prices. Journal of Housing and the Built Environment, 30(3), 427.

ÖNER, Ö. (2014). Retail location (Doctoral dissertation, Jönköping International Business School).

ÖNER, Ö. (2017). Retail city: the relationship between place attractiveness and accessibility to shops. Spatial Economic Analysis, 12(1), 72-91.

PARTRIDGE, M. D., RICKMAN, D. S., ALI, K. and OLFERT, M. R. (2008) The geographic diversity of US nonmetropolitan growth dynamics: A geographically weighted regression approach, *Land Economics* **84**, 241-266.

RIVERA-BATIZ, F. L. (1988) Increasing returns, monopolistic competition, and agglomeration economies in consumption and production, *Regional Science and Urban Economics* **18**, 125-153.

ROBACK, J. (1982) Wages, rents, and the quality of life, *The Journal of Political Economy*, 1257-1278.

ROSEN, S. (1979) Wage-based indexes of urban quality of life, *Current issues in urban economics*, *3*.

SÖDERBERG, B. and JANSSEN, C. (2001) Estimating distance gradients for apartment properties, *Urban Studies* **38**, 61-79.

TYRVÄINEN, L. and MIETTINEN, A. (2000) Property prices and urban forest amenities, *Journal of environmental economics and management* **39**, 205-223.

ULLMAN, E. L. (1954) Amenities as a factor in regional growth, *Geographical Review* **44**, 119-132.

VON THÜNEN, J. H. (1966) *The isolated state*, Wartenberg, CM trans. Translation of: Der isolierte Staat (1826).

TIEBOUT, C. M. (1956) A pure theory of local expenditures, *The journal of political economy* **64**, 416-424.

WEBER, A. (1909) *Über den Standort der Industrien*, JCB Mohr, Tubingen; translated into English as Weber, A (1929) Alfred Weber's Theory of Location of Industries, University of Chicago Press, Chicago, Illinois.

Appendix-1: Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Age	15,993,028	40.02149	12.51737	18	64
Male dummy	15,993,028	1.500409	.4999998	1	2
Human Capital	15,993,028	.2186688	.4133434	0	1
Immigrant	15,993,028	.2269223	.418842	0	1
Cohabitation	15,993,028	.6419937	.479414	0	1
Child below 18	15,993,028	.3883257	.4873693	0	1
Job change t-1	15,993,028	.155446	.3623294	0	1
Distance to work t-1 (ln)	12,921,962	8.872231	1.264538	5.521461	13.86556
Distance to local CBD (ln)	15,780,142	8.11079	.9912628	5.521461	10.99381
Distance to Stockholm CBD (ln)	15,988,754	9.405874	1.115011	5.521461	11.88723
Creative job	13,682,078	.5172944	.4997008	0	1
Service job	13,682,078	.3392311	.4734484	0	1
Average income_ln (1000sqm)	15,993,028	7.700541	.3194133	2.212973	10.34278
Population (density) ln (1000sqm)	15,993,028	7.29406	1.566365	0	9.716556
Share of Human Capital	15,993,028	.0007818	.0098165	0	1
Share_gay	15,993,028	4.32e-06	.000502	0	1
Avrage age (1000sqm)	15,993,028	40.36555	2.510978	18	64
Single share (1000sqm)	15,993,028	.0016241	.0194833	0	1
Immigrant share (1000sqm)	15,993,028	.0006998	.0082932	0	1
Rate of move	15,993,028	.0840933	.0408773	0	1
School (1000sqm)	14,303,720	9.031412	12.87125	0	96
Religious establishment (1000sqm)	14,303,720	1.263401	2.544794	0	21
Health service (1000sqm)	14,303,720	17.00945	34.14769	0	262
Sports venue (1000sqm)	14,303,720	1.855152	3.22874	0	35

Appendix-2: Full specification of the model presented in Table-6

VARIABLES	(1) NoAmenity	(2) PoorAmenity	(3) ModerateAmenity	(4) RichAmenity
Middle Income	**0.0494*** **	**0.0586*** **	**0.0240*** **	**0.00841** **
	(0.0135)	**(0.0128)**	**(0.00592)**	**(0.00376)**
High Income	**-0.0351** **	**-0.0501*** **	**-0.100*** **	**-0.0674*** **
	(0.0165)	**(0.0152)**	**(0.00725)**	**(0.00456)**
Age (ln)	-0.0580***	-0.0598***	-0.0595***	-0.0530***
	(0.000522)	(0.000498)	(0.000242)	(0.000157)
Male dummy	0.0586***	0.0356***	0.00780	0.0112***
	(0.0122)	(0.0110)	(0.00505)	(0.00315)
Human Capital dummy	0.130***	0.129***	0.117***	-0.00961**
	(0.0160)	(0.0134)	(0.00620)	(0.00387)
Immigrant dummy	0.284***	0.295***	0.305***	0.235***
	(0.0158)	(0.0132)	(0.00559)	(0.00355)
Cohabitation	-1.061***	-1.004***	-1.014***	-0.628***
	(0.0148)	(0.0144)	(0.00715)	(0.00456)
Child below 18	-0.0319**	0.0608***	0.202***	-0.0914***
	(0.0145)	(0.0135)	(0.00695)	(0.00509)
Job change t-1	0.225***	0.167***	0.162***	0.191***
	(0.0131)	(0.0120)	(0.00559)	(0.00350)
Distance to work t-1	0.160***	0.148***	0.122***	0.0653***
	(0.00515)	(0.00434)	(0.00192)	(0.00117)
Distance to local CBD (ln)	0.00248	0.0181***	0.00607**	0.0123***
	(0.00829)	(0.00625)	(0.00270)	(0.00179)
Distance to Stockholm CBD (ln)	-0.0290***	-0.0158*	0.00743**	-0.0127***
	(0.0110)	(0.00864)	(0.00372)	(0.00218)
Creative job	0.106***	0.141***	0.106***	0.0557***
	(0.0158)	(0.0152)	(0.00760)	(0.00534)
Service job	0.0976***	0.0703***	0.0478***	0.0552***
	(0.0158)	(0.0154)	(0.00743)	(0.00519)
Average income_ln (1000sqm)	0.123***	0.254***	0.318***	0.107***
	(0.0219)	(0.0226)	(0.0132)	(0.00909)
Population (density) ln (1000sqm)	0.0837***	0.0243***	-0.0247***	-0.0191***
	(0.00702)	(0.00696)	(0.00545)	(0.00417)
Human capital share (1000sqm)	-2.492***	-2.514*	-15.94**	-13.00
	(0.561)	(1.365)	(6.436)	(18.19)
Gay share (1000sqm)	-0.371	15.38	-141.5	2,454
	(7.423)	(26.42)	(146.3)	(2,722)
Average age (1000sqm)	0.0506***	0.0532***	0.0554***	0.0675***
	(0.00165)	(0.00209)	(0.00152)	(0.00135)
Single share (1000sqm)	-5.757***	-6.204***	-11.91***	-8.020***
	(0.306)	(0.661)	(2.249)	(2.579)
Immigrant share (1000sqm)	-2.632***	-1.026	3.609	-3.155
	(0.614)	(1.325)	(4.816)	(8.306)
Rate of move	10.44***	9.476***	9.220***	9.208***

	(0.0603)	(0.0768)	(0.0683)	(0.0671)
School (1000sqm)	-0.0146	-0.00120	0.00174*	-0.000319*
	(0.0109)	(0.00467)	(0.000967)	(0.000178)
Religious est (1000sqm)	0.0348	-0.0261*	-0.00971**	0.00396***
	(0.0281)	(0.0157)	(0.00464)	(0.000879)
Healt service (1000sqm)	-0.00881	-0.00404	-0.00555***	-0.000194**
	(0.0110)	(0.00451)	(0.00106)	(8.95e-05)
Sport venue (1000sqm)	-0.0370*	-0.0337***	-0.0123***	-0.00275***
	(0.0191)	(0.0107)	(0.00231)	(0.000553)
Year dummies	Yes	Yes	Yes	Yes
Constant	-5.278***	-6.162***	-6.324***	-4.885***
	(0.238)	(0.229)	(0.131)	(0.104)
Observations	593,317	695,413	3,118,320	5,741,137
Pseudo R2	0.200	0.140	0.107	0.0829

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1